

# 1910A/1911A

## Multi-Counters

Instruction Manual

P/N 429621  
June 1977  
Rev. 2 9/78



# WARRANTY

Notwithstanding any provision of any agreement the following warranty is exclusive:

The JOHN FLUKE MFG. CO., INC., warrants each instrument it manufactures to be free from defects in material and workmanship under normal use and service for the period of 1-year from date of purchase. This warranty extends only to the original purchaser. This warranty shall not apply to fuses, disposable batteries (rechargeable type batteries are warranted for 90-days), or any product or parts which have been subject to misuse, neglect, accident, or abnormal conditions of operations.

In the event of failure of a product covered by this warranty, John Fluke Mfg. Co., Inc., will repair and calibrate an instrument returned to an authorized Service Facility within 1 year of the original purchase; provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may, at its option, replace the product in lieu of repair. With regard to any instrument returned within 1 year of the original purchase, said repairs or replacement will be made without charge. If the failure has been caused by misuse, neglect, accident, or abnormal conditions of operations, repairs will be billed at a nominal cost. In such case, an estimate will be submitted before work is started, if requested.

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**If any failure occurs, the following steps should be taken:**

1. Notify the JOHN FLUKE MFG. CO., INC., or nearest Service facility, giving full details of the difficulty, and include the model number, type number, and serial number. On receipt of this information, service data, or shipping instructions will be forwarded to you.
2. On receipt of the shipping instructions, forward the instrument, transportation prepaid. Repairs will be made at the Service Facility and the instrument returned, transportation prepaid.

## **SHIPPING TO MANUFACTURER FOR REPAIR OR ADJUSTMENT**

All shipments of JOHN FLUKE MFG. CO., INC., instruments should be made via United Parcel Service or "Best Way" prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid and of adequate size. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

## **CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL PURCHASER**

The instrument should be thoroughly inspected immediately upon original delivery to purchaser. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument is damaged in any way, a claim should be filed with the carrier immediately. (To obtain a quotation to repair shipment damage, contact the nearest Fluke Technical Center.) Final claim and negotiations with the carrier must be completed by the customer.

The JOHN FLUKE MFG. CO., INC., will be happy to answer all applications or use questions, which will enhance your use of this instrument. Please address your requests or correspondence to: JOHN FLUKE MFG. CO., INC., P.O. BOX C9090, EVERETT, WASHINGTON 98206, ATTN: Sales Dept. For European Customers: Fluke (Holland) B.V., P.O. Box 5053, 5004 EB, Tilburg, The Netherlands.

\*For European customers, Air Freight prepaid.

**John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, Washington 98206**

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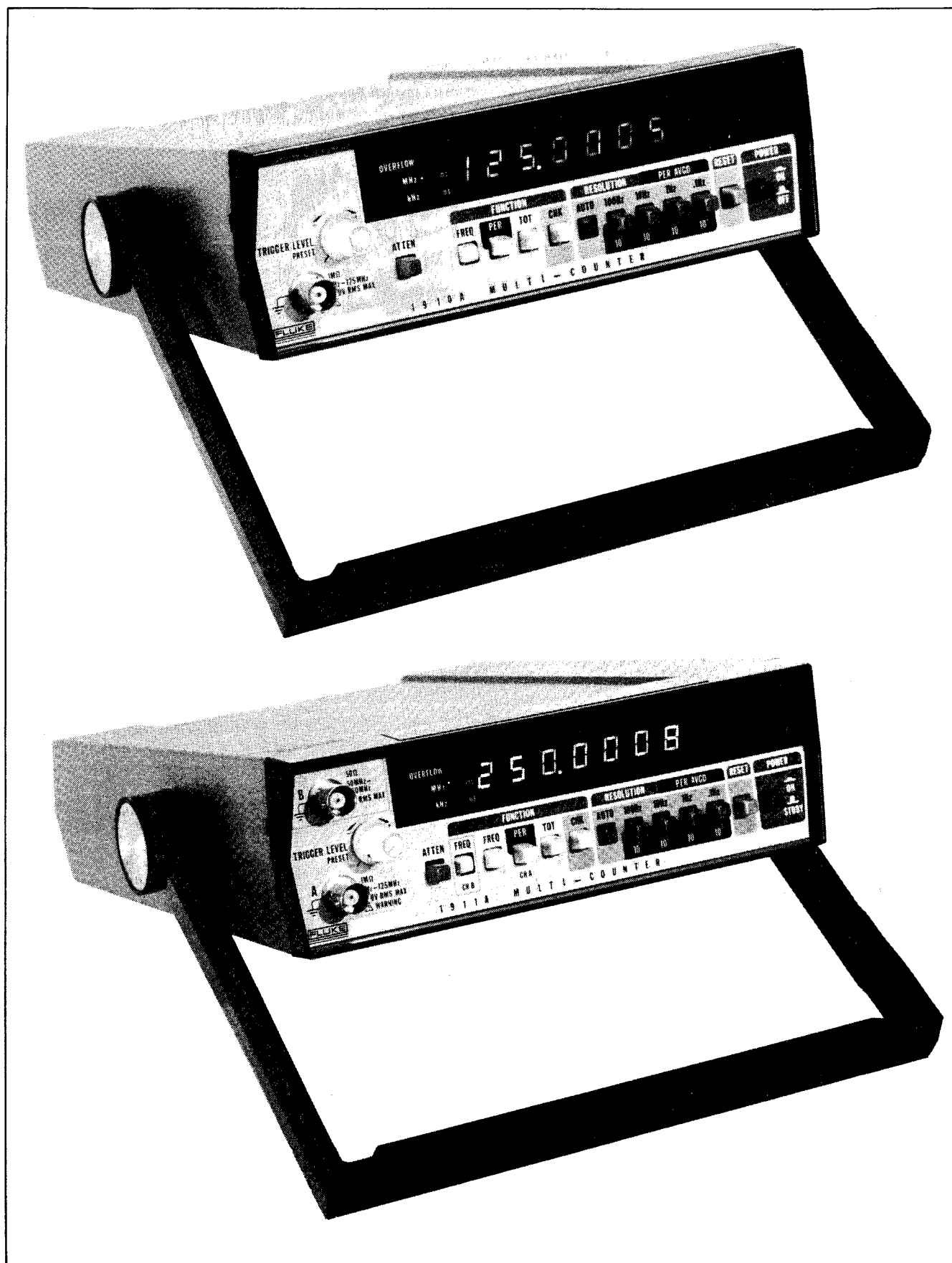
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1910A/1911A Multi-Counters



## Section 1

## Introduction &amp; Specifications

## 1-1. INTRODUCTION

1-2. This manual has been designed such that the information presented will pertain to two similar multi-counters, the 1910A and the 1911A. Any information, figures, tables, or general data that is unique to either one or the other, but not both will be denoted with the model number of the instrument that the information pertains to.

## NOTE

*The BNC input connector on the model 1910A has no channel designation. Its operation is identical to the 1911A channel A BNC input connector and will be referred to as channel A throughout this manual.*

1-3. The measurement display of both units uses light-emitting-diodes (LED's) to illuminate 7 display digits and three annunciators. The annunciators are provided to indicate measurement units (kHz, MHz, msec, and usec) and an overflow indication when the capacity of the display is exceeded. The counter uses 0.3 inch high display LED's with leading zero suppression and automatic decimal positioning to assure fast and accurate reading.

1-4. A self-check mode of operation is provided on the counter to verify operation of every section but the pre-amplifiers and the time base itself. To insure precise triggering, the counter is equipped with an approximate 10:1 attenuator for high level inputs or high noise environments. It also utilizes a variable trigger level, which may be adjusted to assure stable triggering or left at the preset value.

1-5. Several options and accessories are available for use with the 1910A and 1911A. The options are listed in Table 1-1, and must be specified at the time of purchase. Table 1-2 lists the available accessories. The accessories are compatible with all options and may be ordered at the time of purchase or later. Detailed information concerning each option and accessory is given in Section 6 of this manual.

Table 1-1. 1910A/1911A Options

OPTION NO.	DESCRIPTION
-01	Battery Power Supply
-02	Data Output Unit
-03	TCXO, 10 MHz, 2 PPM
-04	TCXO, 10 MHz, 0.5 PPM

Table 1-2. 1910A/1911A Accessories

ACCESSORY MODEL NO.	DESCRIPTION
MOO-100-714	Dust Cover
MOO-200-611	Offset Rack Adapter
MOO-200-612	Center Rack Adapter
MOO-200-613	Dual Rack Adapter (For two 1910A's/1911A's or one 1910A/1911A with either an 8000A or 8600A).
C-80	Vinyl Case Cover with Accessory Pouch
C-86	Carrying Case (For a single 1910A/1911A)
C-85	Dual Carrying Case (For two 1910A's/1911A's or a 8000A or 8600A)
A-53	Telescope Whip Antenna

## 1-6. Model 1910A Characteristics

1-7. The Model 1910A is a Digital Multi-Counter capable of making 3 basic measurements: frequency, period, and totalize, over a 5 Hz to 125 MHz range for the frequency mode, and 5 Hz to 2 MHz in the period mode. Resolution of the period and frequency modes may be manually selected from four ranges (resolution in the totalize mode is unnecessary). In the frequency mode the four ranges of resolution are: 0.1 Hz, 1.0 Hz, 10 Hz, and 100 Hz; while in the period mode there are  $10^0$ ,  $10^1$ ,  $10^2$ , and  $10^3$  periods averaged. In conjunction with the four manual resolution selections the counter provides an autorange circuit which, when activated, optimizes the three lowest resolutions (1.0, 10, and 100 Hz) by seeking to fill all dis-

play digits. The highest resolution range (0.1 Hz) must always be manually selected. In the period mode autorange will select  $10^0$ ,  $10^1$ ,  $10^2$ ,  $10^3$ , and  $10^4$  periods averaged in seeking to fill all display digits.

### 1-8. Model 1911A Characteristics

1-9. The Model 1911A is also a Digital Multi-Counter capable of making not only the measurements of the

1910A, but its input range has been expanded with the addition of a prescaler and an input channel B to cover the 50 MHz to 250 MHz spectrum in the frequency mode.

### 1-10 SPECIFICATIONS

1-11. Specifications for the 1910A and 1911A are presented in Table 1-3. Those places where specifications do not apply to both instruments have been marked.

Table 1-3. 1910A/1911A Specifications

OPERATING RANGES

FREQUENCY CHANNEL A . . . . .

FREQUENCY CHANNEL B (1911A ONLY) . . . . .

PERIOD CHANNEL A . . . . .

TOTALIZE CHANNEL A . . . . .

5 Hz - 125 MHz

50 MHz - 250 MHz

5 Hz - 2 MHz

1 COUNT TO 9999999

TIME BASE

Standard

-03 Option

-04 Option

FREQUENCY . . . . .

AGING RATE . . . . .

TEMPERATURE DEPENDENCE . . . . .

20 to 30°C

LINE VOLTAGE DEPENDENCE FOR  
± 10% CHANGE . . . . .

10 MHz

(2 ppm TCXO)  
10 MHz

(0.5 ppm TCXO)  
10 MHz

±5 x 10<sup>-7</sup> /mo

±3 x 10<sup>-7</sup> /mo

±3 x 10<sup>-7</sup> /mo

0 to 50°C

±5 x 10<sup>-6</sup>

±2 x 10<sup>-6</sup>

±3 x 10<sup>-7</sup>

+1 x 10<sup>-6</sup> (typ)

±1 x 10<sup>-7</sup>

±2 x 10<sup>-8</sup>

±2 x 10<sup>-8</sup>

CHARACTERISTICS (ELECTRICAL)

CHANNEL A

INPUT IMPEDANCE . . . . .

SENSITIVITY . . . . .

ATTENUATOR . . . . .

TRIGGER LEVEL . . . . .

OVERLOAD LEVEL . . . . .

1M ohm shunted by less than 30 pf, AC coupled.

15 mV rms: 5 Hz to 100 MHz

25 mV rms: 100 MHz to 125 MHz

Decreases sensitivity by approximately 10.

±0.5 V

DC + AC: Less than 360V peak.

AC: 250V rms 5 Hz to 1 kHz. 10V rms above 1 kHz.

(30V peak when operating from Batteries)

CHANNEL B (1911A ONLY)

INPUT IMPEDANCE . . . . .

SENSITIVITY . . . . .

OVERLOAD . . . . .

50 ohms nominal. VSWR less than 2.5:1

Less than 15 mV rms: 50 MHz to 175 MHz

Less than 30 mV rms: 175 MHz to 250 MHz

DC + AC: Less than 100V peak (30V Peak when operating from bat-

teries). AC: 5V rms, fuse protected.

Table 1-3. 1910A/1911A Specifications (Continued)

## EXTERNAL TIME BASE INPUT

FREQUENCY REQUIRED ..... 10 MHz  
 SENSIVITY ..... 300 mV rms  
 INPUT IMPEDANCE ..... Greater than 1k ohm  
 MAXIMUM INPUT ..... 5V pk-pk

## RESOLUTION

FREQUENCY ..... Four manually selected resolutions of 100 Hz, 10 Hz, 1 Hz and .1 Hz.  
 Autorange will automatically seek to fill all seven digits but will not select a resolution better than 1 Hz.

PERIOD ..... Manual selection provides single period measurement, or the averaging of  $10^1$ ,  $10^2$ , or  $10^3$  periods.  
 $10^0$  single period (100 ns resolution)  
 $10^1$  periods averaged (10 ns resolution)  
 $10^2$  periods averaged (1 ns resolution)  
 $10^3$  periods averaged (100 ps resolution)  
 Autorange will automatically seek to fill all seven digits and, if the input frequency is high enough, may select  $10^4$  periods averaged (10 ps resolution), but will not select a gate time greater than 1 sec.

TOTALIZE ..... Accumulates up to 9999999 counts then reset to zero and activates overflow indicator.

## GENERAL

DISPLAY ..... 7 digit LED, Leading zero suppression.

ANNUNCIATION ..... MHz, kHz, msec, usec, overflow

Time between successive measurements is 200 ms nominal plus measurement time.

AUTORANGE ..... In both frequency and period modes autoranging includes a unique 20% hysteresis in its switching thresholds to eliminate redundant up range/down range commands. This allows measurement to be made on signals containing large amounts of FM and PM. Hysteresis can be reset by depressing reset button.

AUTORESET ..... A new measurement sequence is started every time a front panel push button is activated except the attenuator.

OPERATING TEMPERATURE ..... 1910A/1911A: 0°C to 50°C  
 1910A/1911A-01: 0°C to 40°C if operating from line.

STORAGE TEMPERATURE ..... 1910A/1911A: -40°C to +70°C  
 1910A-01/1911A-01: -40°C to +60°C

Table 1-3. 1910A/1911A Specifications (Concluded)

POWER REQUIREMENTS . . . . .	1910A/1911A:	100/115/230 $\pm$ 10%, 48 - 440 Hz, 8W max.
	1910A/1911A/1911A-01:	100V $\pm$ 10%, 48 - 52 Hz
		100V $\pm$ 10%, 58 - 62 Hz
		115V $\pm$ 10%, 58 - 62 Hz
		230V $\pm$ 10%, 48 - 52 Hz, 8.5W max.

*NOTE! Voltage and frequency must be specified at time of order.*

DIMENSIONS . . . . .	Width:	8.55 inches 217.2 mm
	Height:	2.52 inches 64 mm
	Depth:	10.65 inches 271.0 mm

WEIGHT . . . . .	1910A/1911A:	3.2 lbs max.	1.5 kgm max.
	1910A-01/1911A-01:	4.8 lbs max	2.2 kgm max.

#### OPTION -01 (BATTERY)\*

TYPE . . . . . Rechargeable Nicad

CHARGE TIME . . . . . 16 hrs with power switch off at less than 30°C.

OPERATING TIME . . . . . 4 hrs minimum (Battery capacity reduced if charged at greater than 30°C.).

#### OPTION -02 (DATA OUTPUT)\*

DATA OUTPUTS . . . . . 7 digits with overflow decimal and units information in BCD parallel/  
digit serial format at CMOS levels.

OTHER INPUTS . . . . . 7 digit strobe signals. Update signal, leading zero suppression signal.

#### TCXO

TIME BASES . . . . . (See time base characteristics for detail specifications)

OPTION -03 . . . . . 2 ppm TCXO

OPTION -04 . . . . . 0.5 ppm TCXO

*Note! All options must be installed at time of ordering. No options are field installable.*

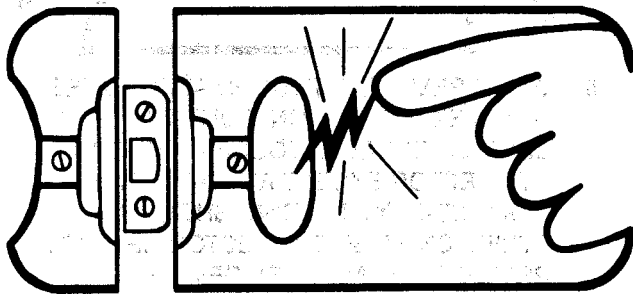
*\*Due to space limitations within the instrument the 1910A and 1911A may be ordered with either option, -01 or -02, but not both options.*



# static awareness



A Message From  
**John Fluke Mfg. Co., Inc.**



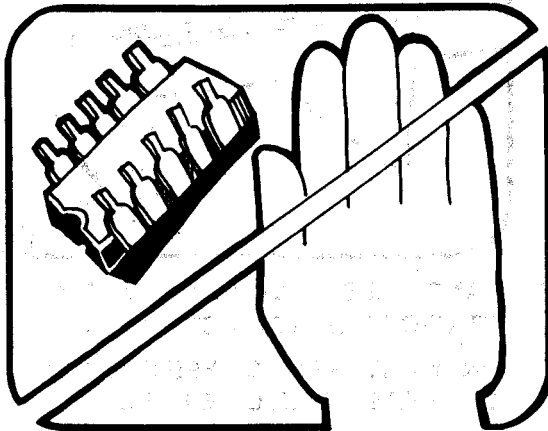
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

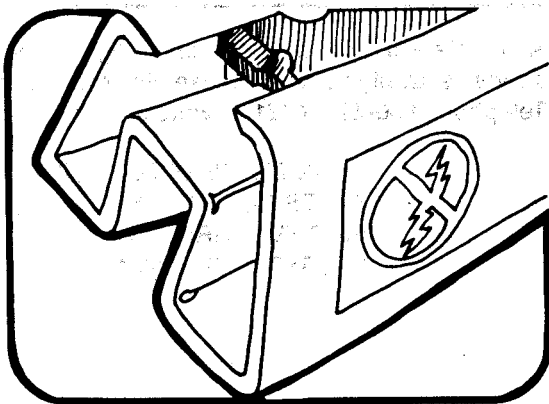
The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol



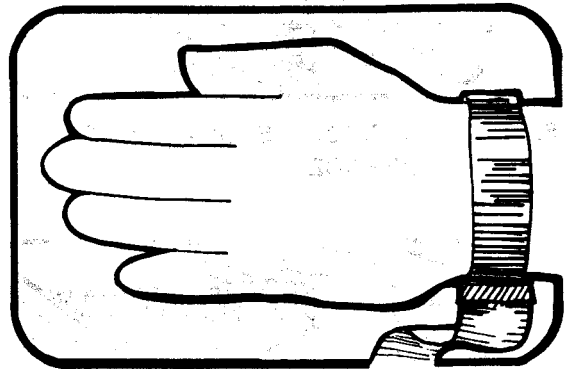
The following practices should be followed to minimize damage to S.S. devices.



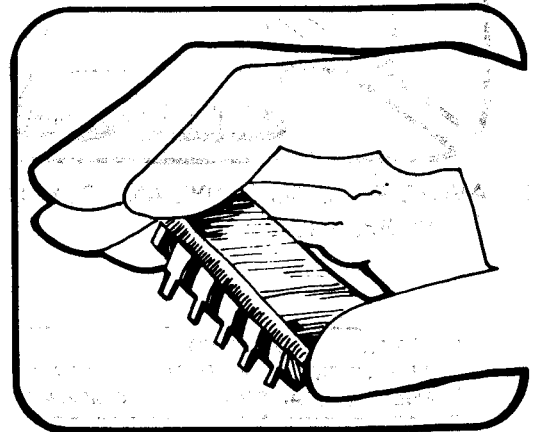
1. MINIMIZE HANDLING



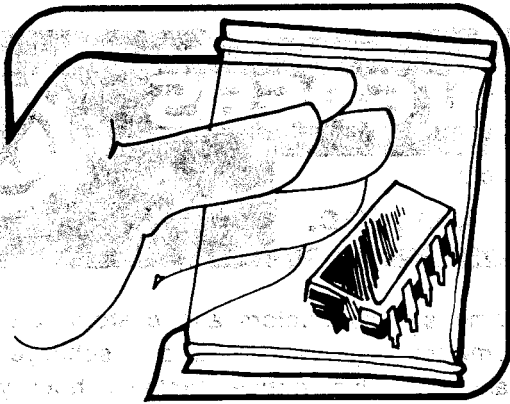
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



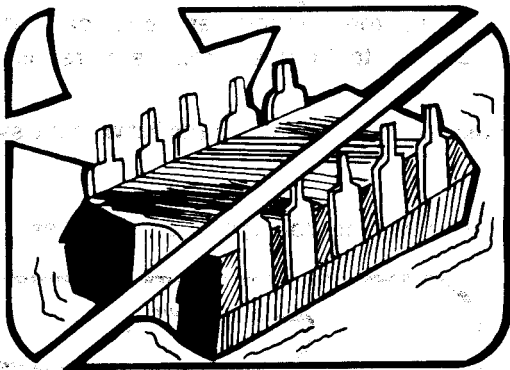
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES. USE A HIGH RESISTANCE GROUNDING WRIST STRAP.



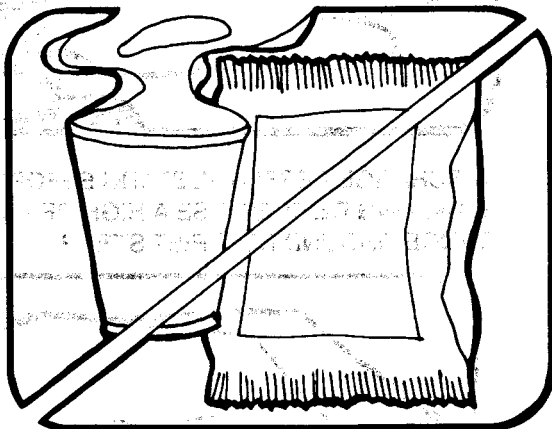
4. HANDLE S.S. DEVICES BY THE BODY



5. USE STATIC SHIELDING CONTAINERS FOR HANDLING AND TRANSPORT

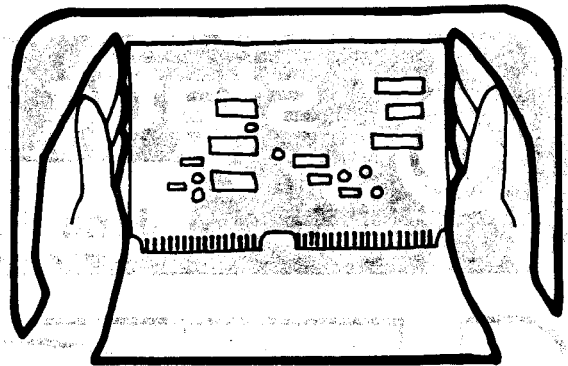


6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE

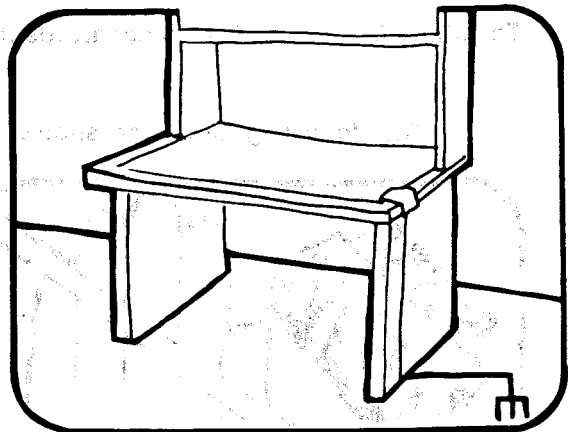


7. AVOID PLASTIC, VINYL AND STYROFOAM® IN WORK AREA

PORTIONS REPRINTED  
WITH PERMISSION FROM TEKTRONIX, INC.  
AND GENERAL DYNAMICS, POMONA DIV.



8. WHEN REMOVING PLUG-IN ASSEMBLIES, HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR HELPS TO PROTECT INSTALLED SS DEVICES.



9. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION  
10. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.  
11. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

A complete line of static shielding bags and accessories is available from Fluke Parts Department, Telephone 800-526-4731 or write to:

JOHN FLUKE MFG. CO., INC.  
PARTS DEPT. M/S 86  
9028 EVERGREEN WAY  
EVERETT, WA 98204

## Section 2

# Operating Instructions

### 2-1. INTRODUCTION

2-2. This section contains information regarding the installation and operation of the Model 1910A and 1911A. The contents of this section should be read before operating the instrument. Should any difficulties be encountered during operation, please contact your nearest authorized John Fluke Technical Service Center. A list of Technical Service Centers is located in Section 7.

### 2-3. SHIPPING INFORMATION

2-4. The counter is packaged and shipped in a protective container. Upon receipt of the equipment, a thorough inspection should be made to reveal any possible shipping damage.

2-5. If reshipment of the equipment is necessary, the original container should be used. If the original container is not available, a new container can be obtained from the John Fluke Mfg. Co. Please reference the equipment model number when requesting a new shipping container.

### 2-6. INPUT POWER, LINE

2-7. The counter has three available input power configurations: 100V, 115V, and 230V, all compatible with line frequencies between 48 and 440 Hz. See Section 6 for battery power requirements.

#### NOTE

*A decal on the bottom of the instrument indicates the AC line voltage and frequency the instrument will operate from.*

### 2-8. RACK INSTALLATION

2-9. The 1910A/1911A is designed for either bench top use or for installation in a standard 19-inch equipment rack, using an optional accessory rack mounting kit. Rack

mounting kits are available for left, right, center, or side-by-side mounting of the 1910A/1911A. Installation information of the rack mounting accessories is given in Section 6 under Rack Installation.

### 2-10. OPERATING FEATURES

2-11. The location and function of all controls, connectors, and indicators are shown in Figure 2-1, and defined in Table 2-1.

### 2-12. OPERATING NOTES

#### 2-13. Fuse

2-14. The line fuse, F1, is located on the instrument rear panel, (see Figure 2-1), the fuse required is an AGC 1/8 amp slow blow, for 100V and 115V line, 1/16 amp slow blow for 230V line, and a ½ amp slow blow for all battery configurations.

#### 2-15. Input Connection

2-16. Signals to be measured by the Model 1910A are applied to the front panel BNC connector. Connection of all input signals should be by means of coaxial-type cable fitted with a mating BNC connector. Input impedance is 1 megohm shunted by less than 30 pF, AC coupled.

2-17. Signals to be measured by the Model 1911A may be applied to either the designated channel A front panel BNC connector for inputs between 5 Hz and 125 MHz, or to the designated channel B front panel BNC connector for inputs between 50 MHz and 250 MHz. Connection of all input signals should be by means of coaxial-type fitted with a mating BNC connector. Input impedance is 50 ohms nominal on channel B.

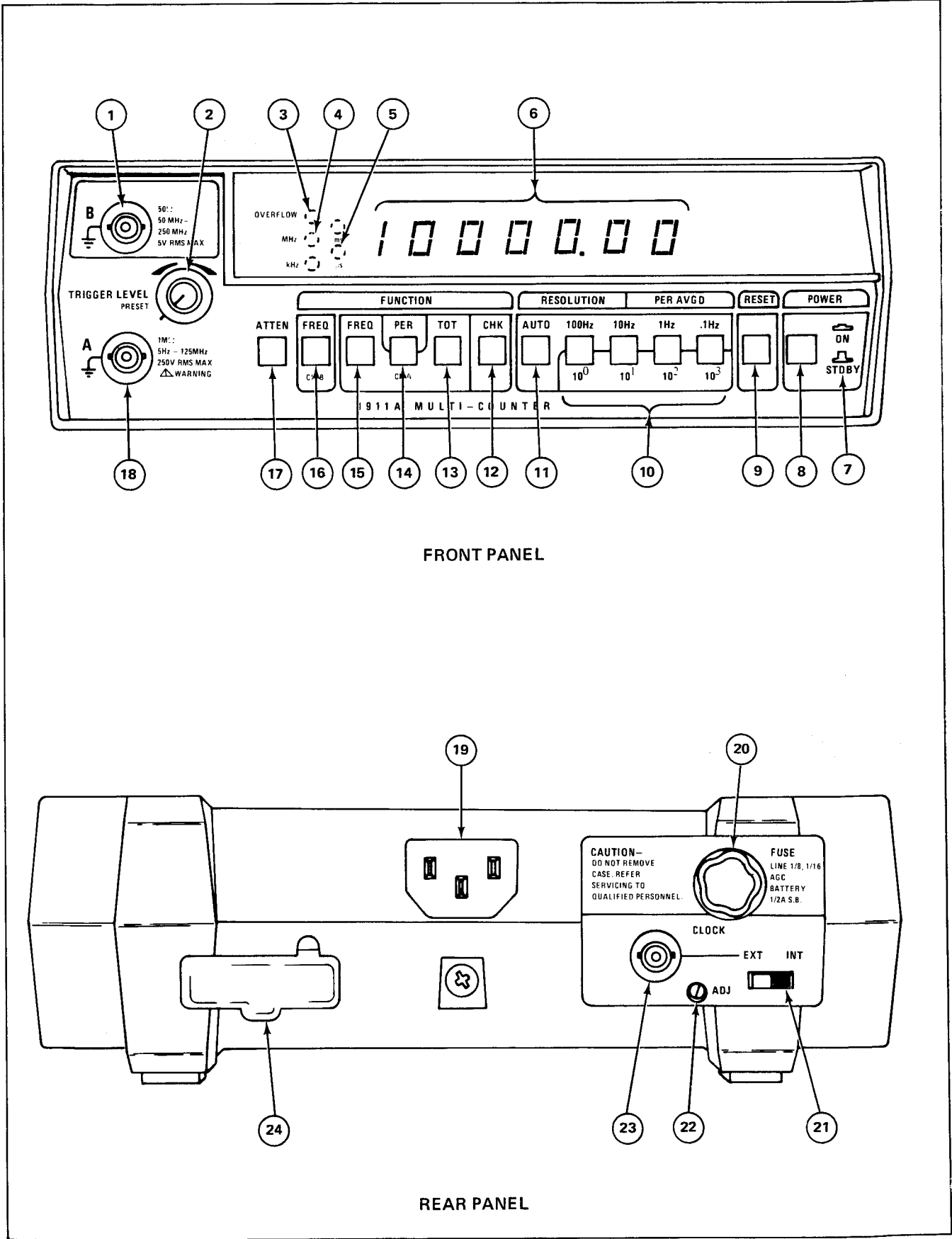


Figure 2-1. 1910A/1911A Control and Indicator Locations



Table 2-1. 1910A/1911A Control and Indicator Functions

Fig. 2-1. REF. NO.	NAME	FUNCTION
1	BNC Input Connector Channel B (1911A only)	Accepts input frequencies of 50 MHz to 250 MHz @ 5V rms max.
2	Triggering Level	Selects manual or preset triggering level of Channel A.
3	Annunciator	Overflow-lights to show count exceeds display capacity.
4	Annunciator	Illuminates to identify display units, MHz/ms.
5	Annunciator	Illuminates to identify display units, kHz/us.
6	Data Display	Seven LED Digits with leading zero suppression.
7	STDBY-01 Option	When power switch is in this position with the -01 option installed the unit is off but the batteries are still being charged (if unit is connected to the line).
8	Power Switch	Two position: in (unit on) out (unit off).
9	Reset Switch	Manually resets front panel & sequencer, U6.
10	Resolution Switches	Manually selects gate time; or period resolution.
11	Resolution Switch	Selects auto-range in freq. and period modes.
12	Function Switch	Selects self-check.
13	Function Switch	Selects totalize function, 1 count to 9999999.
14	Function Switch	Selects period function, 5 Hz to 2 MHz. (Channel A only)
15	Function Switch	Selects frequency function, 5 Hz to 125 MHz.
16	Function Switch Chan B, (1911A only)	Selects frequency function, 50 MHz to 250 MHz.
17	Attenuator Switch	Selects 10:1 attenuation for high level inputs on channel A.
18	BNC Input Connector Front Panel Chan A	Accepts input freq. of 5 Hz to 125 MHz.
19	3 Prong Connector	Provides connection for line voltage.
20	Fuse Holder	1/8, 1/16 Amp fuse, slow blow line versions. 1/2 amp fuse slow blow battery version.
21	Mode Switch	Selects reference frequency, internal or external.
22	Standard Time Base Y1 adjustment	Provides calibration adjustment of Y1 without removing unit from case.
23	Clock Input Connector	Provides input connection for 10 MHz clock signal.
24	DOU Output Connector -02 Option	Provides output connector for DOU data ( in BCD serial format).

**2-18. AC Line Connection**

2-19. The input power cord is a three prong polarized connector which permits connection to all selected line configurations. Insure that the ground pin on the power cord is connected to a high quality earth ground.

**2-20. Overload Protection****WARNING**

**THE OUTSIDE CONTACT OF THE INPUT BNC CONNECTOR IS TIED DIRECTLY TO EARTH GROUND THROUGH THE POWER PLUG. DO NOT CONNECT THE ACTIVE LEAD OF THE INPUT SIGNAL TO THE**

**OUTSIDE CONTACT. IRREPAIRABLE DAMAGE TO THE COUNTER OR EQUIPMENT UNDER TEST MAY RESULT. TO MEASURE POWER LINE FREQUENCIES IT IS RECOMMENDED TO USE A STEPDOWN TRANSFORMER TO THE COUNTER INPUT.**

2-21. The Model 1910A will accept inputs as high as 250 Vac rms at frequencies between 5 Hz and 1 kHz. At frequencies above 1 kHz the ac overload protection decreases to 10 Vac rms. The 1910A will withstand peak voltages, dc and ac up to 350V. On 1910A-01/1911A-01 instruments, operating from battery power, the input must be restricted to 30V peak. The Model 1911A will accept peak input voltages as high as 100V dc and ac on channel B.

**2-22. Frequency Measurements**

2-23. Perform frequency measurements as follows:

1. Depress the POWER switch to the ON position.
2. Depress the FREQ switch to select the frequency mode of operation.
3. Select the desired resolution, or the autorange mode by pressing the AUTO switch. If the input signal is completely unknown, the autorange mode will select the optimum range.

**NOTE**

*In the autorange mode, automatic selection is made between the lower three resolutions. The 0.1 Hz resolution can only be manually selected, (by means of the 0.1 Hz resolution switch).*

4. Connect the input signal to the front-panel BNC connector channel A. If the input is unstable due to noise the reading may improve by using the attenuator switch, and/or the trigger level adjustment.
5. Read the frequency on the display, and observe the unit of measurement indication, (kHz or MHz), to the left of the display.

**2-24. Frequency Measurement, Channel B (1911A Only)**

2-25. Perform the frequency measurement as follows:

1. Depress the POWER switch in (ON).
2. Select the frequency B mode of operation.
3. Select the desired resolution or autorange.
4. Connect the input signal to the front-panel BNC connector designated Channel B.
5. Observe that the display and the annunciators read correctly.

**2-26. Period Measurement**

2-27. Perform period measurement as follows:

1. Depress the POWER switch to the ON position.
2. Depress the PER switch to select the period mode of operation.
3. Select the desired number of periods to be averaged or the autorange mode by depressing the AUTO switch. If the input signal is completely unknown, the autorange mode will select the optimum number of periods to be averaged. The autorange mode will make selections between  $10^0$ ,  $10^1$ ,  $10^2$ ,  $10^3$  and  $10^4$  periods to be averaged.

4. Connect the input signal to the front-panel channel A, BNC connector.
5. Read the period time on the display.

**2-28. Totalize Measurement**

2-29. Perform the totalize measurement as follows:

1. Depress the POWER switch to the ON position.
2. Depress the TOT switch to select the totalize mode of operation, and the RESET switch to initialize the counter.
3. Connect the input signal to the front-panel BNC connector channel A.
4. Observe the display.

**2-30. Self-Check Mode**

2-31. The self-check mode provides a means of verifying proper overall operation of the counter, excluding: A and B input section and accuracy of time base. To self-check the unit proceed as follows:

1. Press the POWER switch to the ON position.
2. Press the CHK switch to select the self-check mode.
3. Press the 100 Hz RESOLUTION switch; the display should read 10.0000 MHz.
4. Press the 10 Hz RESOLUTION switch; the display should read 10000.00 kHz.
5. Press the 1 Hz RESOLUTION switch; the display should read 0000.000 overflow, kHz.
6. Press the 0.1 Hz RESOLUTION switch; the display should read 000.0000 overflow, kHz.
7. Press the AUTO switch; the display should read 10000.00 kHz.
8. Press the RESET switch; the display should read 88888.88.

**2-32. Input Conditioners (Channel A)**

2-33. The counter employs two input conditioners located on the front panel. One is the attenuator switch and the other is the adjustable triggering level.

2-34. The attenuator switch is a two position on/off switch used to decrease the input level by a factor of approximately 10. The attenuator obtains this factor by reducing the gain and increasing the hysteresis to the custom IC, U1.

2-35. The adjustable triggering level is used to bias the broadband amplifier, (contained in U1), at a preset value, or may be adjusted manually to compensate for noisy inputs or pulse measurement.

## Section 3

# Theory of Operation

### 3-1. INTRODUCTION

3-2. This section of the manual is divided into two parts, Overall Block Diagram Description and Functional Block Diagram Description. Overall Block Diagram Description generalizes the operation of each section and explains its function with relation to all associated sections. Functional Block Diagram Description details individual section operation with reference to the controller (U6). Simplified block diagrams are referred to by figure number, and complete schematic diagrams are located in Section 8.

#### NOTE

*Unless otherwise designated all information presented in this section pertains to both the Model 1910A and 1911A multi-counters.*

### 3-3. OVERALL BLOCK DIAGRAM DESCRIPTION

3-4. Eight basic sections compose the circuitry of the Model 1910A and 1911A. They are: input section, power supply, time base, main gate, high speed dividers, accumulator (U7), controller (U6), and display. In addition to the eight basic sections the 1911A has a prescaler.

### 3-5. Frequency Mode (3.8 MHz Test Case)

3-6. To simplify the explanation of the overall circuit functions, assume that a 3.8 MHz signal has been applied to channel-A of the 1910A/1911A and that the 100 Hz resolution and frequency mode switches have been selected. The waveforms shown in Figure 3-1 give an exploded view of the information contained on a particular line for that instant of time. For a complete list of these waveforms see Section 6, Figure 602-1. It should be noted that Figure 3-1 is only an overall block diagram and will not be configured exactly the same for the different modes of operation (see Functional Block Diagram Description). However, since the frequency mode has been selected for

this test case, Figure 3-1 will be referenced to in the following discussion.

3-7. For the frequency mode of operation the signal to be measured is applied to U1 which basically transforms it to standard ECL levels for application to the main gate. The ECL level will be passed to the high speed dividers for a time determined by the selected range. The high speed dividers then divide the unknown input to obtain the first and second digit information. This information is applied to the counters within U7 to obtain the rest of the digit information. The high speed dividers are necessary because the maximum toggle speed of the counters within U7 is 2 MHz. The digit information is strobed into the latches by a memory update signal (MUP) generated by the controller U6. U6 also applies a pulse simultaneously with the digit strobe to position the decimal and to light the appropriate annunciators. The latches (within U7) will hold and present the entire digit information to the display on a common data bus. U7 also generates the strobe cycle to enable the correct LED to light. Each LED is strobed individually for a period of 90 usecs. This individual strobe scheme increases the LED life and decreases the energy consumption, persistence of the eye eliminates any flicker.

3-8. In review of this test case it can be seen that to obtain a count in the frequency mode the 1910A/1911A has utilized all seven of its basic sections. Each of these sections will be discussed in detail under the block diagram analysis. However, because one section, the controller, is basic to every other section and is essential to the operation of the 1910A/1911A in each mode of operation, it will be discussed now.

### 3-9. Controller (U6)

3-10. The controller (U6) is the basis of both the 1910A and 1911A multi-counters. Comprehension of its logic is necessary before proceeding to the other sections.

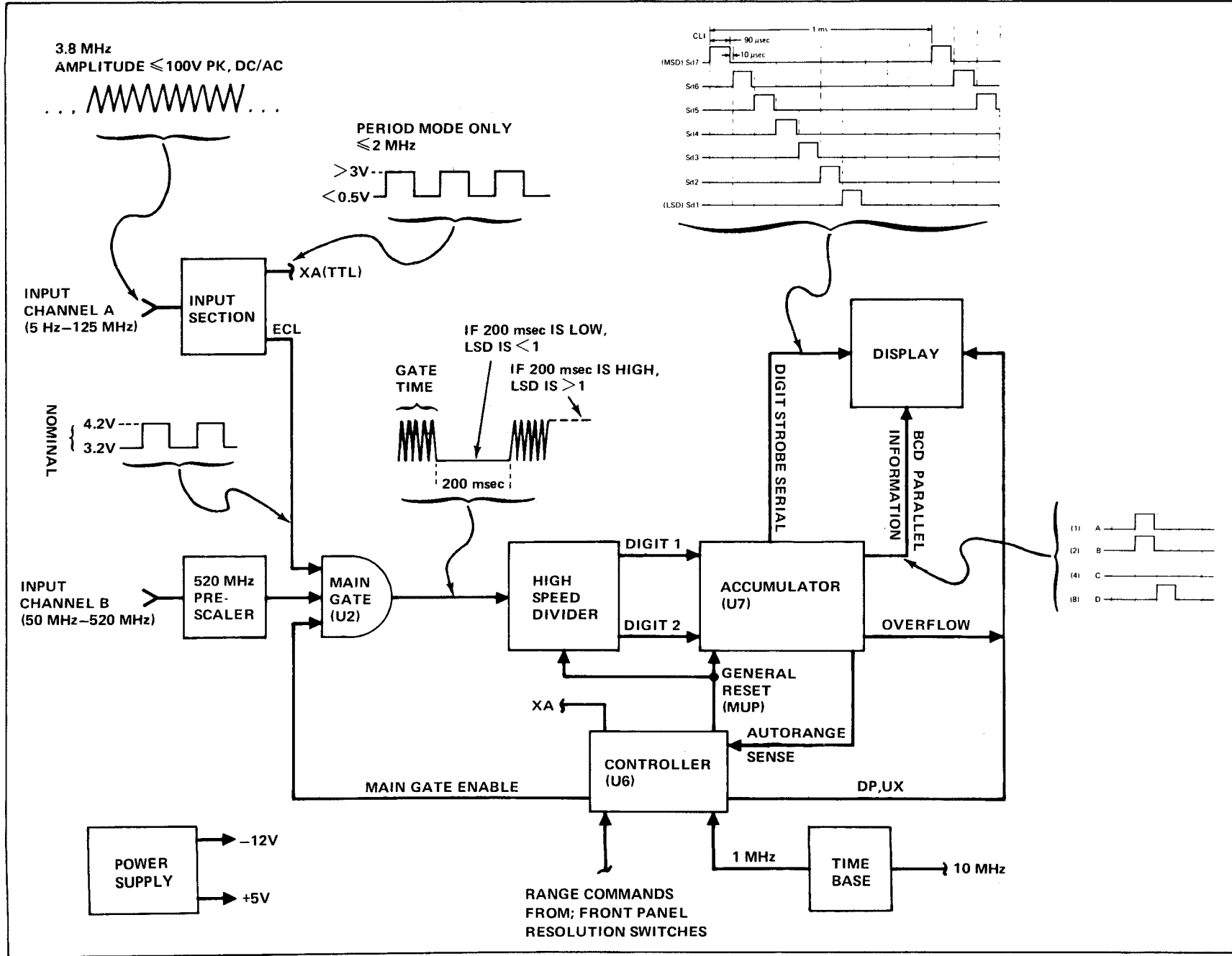


Figure 3-1. 1910A/1911A Overall Block Diagram

3-11. The controller is capable of performing numerous logic steps, see Figure 3-2, the first of which is start (step-1). Step-1 will be initiated whenever power is first applied to the counter, or if a new range, mode, or the reset switch has been actuated. Step-1 will initialize the counter to accept a new measurement. Step-2 is skipped as only odd numbered steps are used to order events. Step-3, the next event in the controllers logic enables the decade counters contained within the accumulator (U7) to count the frequency of the unknown signal.

3-12. Step-5 enables the autorange circuit. In this step the controller decides whether or not the range is adequate for optimum resolution. If the most significant digit (MSD) is less than one the optimum range has not been achieved and the controller will increase the gate time by a factor of 10. The controller will cycle through this until the MSD is one or greater, or until the longest gate time allowed has been reached. If a range has been manually selected then the resolution of the display (gate time) will be determined by the selected range, not the value of the MSD.

3-13. When in the autoranging mode, the controller provides a hysteresis circuit which prevents a shift in range when the frequency of the input signal changes by up to 20%. To activate the circuit the MSD must first be equal to one which sets the hysteresis flip-flop (HFF) high. The hysteresis then introduced by the controller will tend to hold the present range until the second significant digit (2SD) falls below 8.

3-14. Step-7 is called memory update (MUP). This step enables the controller to shift the count obtained in step-3 to the display. Step-9 is a wait period of 200ms which limits the controller to a maximum of five readings per second.

3-15. The controller logic will continue to cycle from step-3 through step-9 once every 200 ms plus the selected gate time. The controller will only revert to step-1 when the instrument is first turned on or if a new function, range or the reset switch is actuated.

### 3-16. Frequency Mode 1911A

3-17. The frequency mode of operation for the 1911A is identical to the 1910A's while using the channel A input. When channel B is selected the input must be applied to the channel B input where it is divided by a factor of 2 in the prescaler, refer to Figure 3-3. The decrease in frequency is necessary because the high speed decade counters have a maximum toggle speed of approximately 150 MHz. The rest of the frequency mode sequence is identical to that of the 1910A.

### 3-18. Period Mode

3-19. The period of an unknown signal is measured by counting a reference frequency during a specified number of input periods. The 1910A and 1911A models obtain their period measurement by applying the unknown input to the range control, using that input to derive the gate time, then counting the 10 MHz signal supplied by the time base. Figure 3-4 illustrates the configuration of the 1910A and 1911A in the period mode. Selection of the range control will directly determine the resolution of the period measurement. The longer the gate time, the more periods averaged, and hence better resolution.

### 3-20. Totalize Mode

3-21. The totalize mode is used to count the total number of events as they happen. This is achieved by bypassing the range and controller functions (see Figure 3-5) and continuously enabling the main gate. The totalize mode will count up to 9999999 at which time the overflow indicator will light, the display will reset to zero and resume counting. The overflow indicator is the only annunciator used in totalize mode and the decimal point is not displayed. A new count may be manually initiated by depressing the reset button located on the front panel.

### 3-22. Self Check Mode

3-23. The self check mode is an internal verification system that uses the 10 MHz signal from the time base as an input. When in the self check mode manual selection of each range will verify the operation of all sections of the counter except the input sections and the time base accuracy. See Table 3-1 for correct display reading and Figure 3-6 for the simplified block diagram.

Table 3-1. Display Readout in Self Check Mode

MODE	DISPLAY	ANNUNCIATOR
Auto	10000.00	kHz
100 Hz	10.0000	kHz
10 Hz	10000.00	kHz
1 Hz	0000.000	Overflow kHz
0.1 Hz	000.0000	Overflow kHz
Reset	888.8888	kHz

### 3-24. FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

3-25. The Functional Block Diagram Description of the multicounter may be broken down into three basic sections: input, time base and display. The input section will explain the conditions of channel A and channel B (1911A only) input signals. It will also include the operation of the main gate. The second section will treat all other circuits which condition the input signal. These are: time base, decimal logic, range and autoranging logic. The last section, display, will explain how the conditioned input is displayed for visual reading.

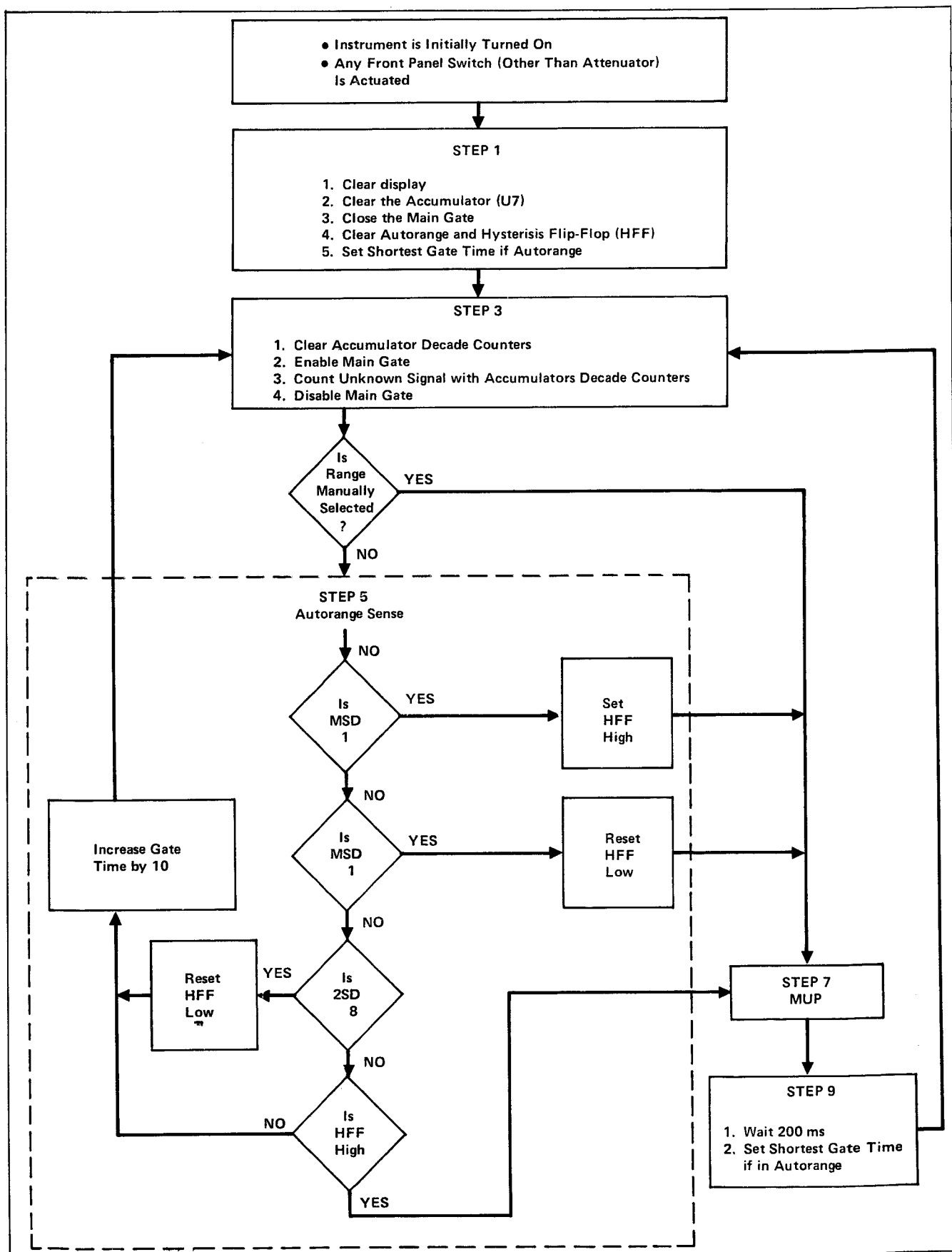


Figure 3-2. Controller Logic

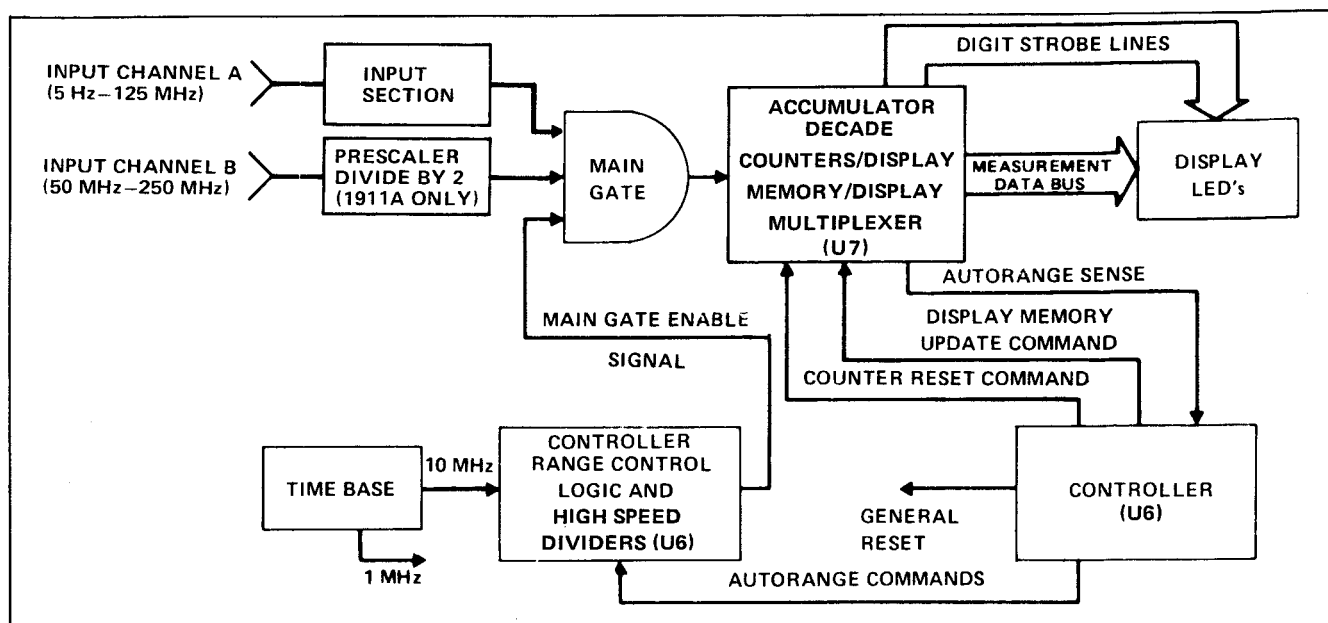


Figure 3-3. Frequency Mode

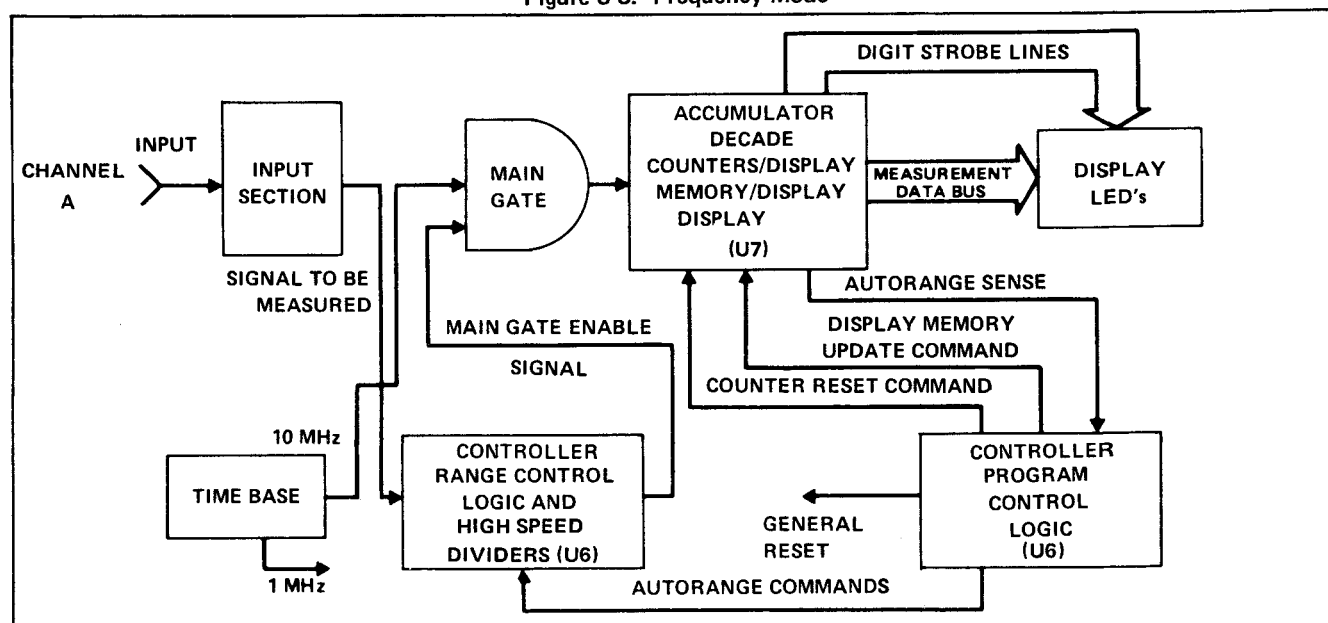


Figure 3-4. Period Mode

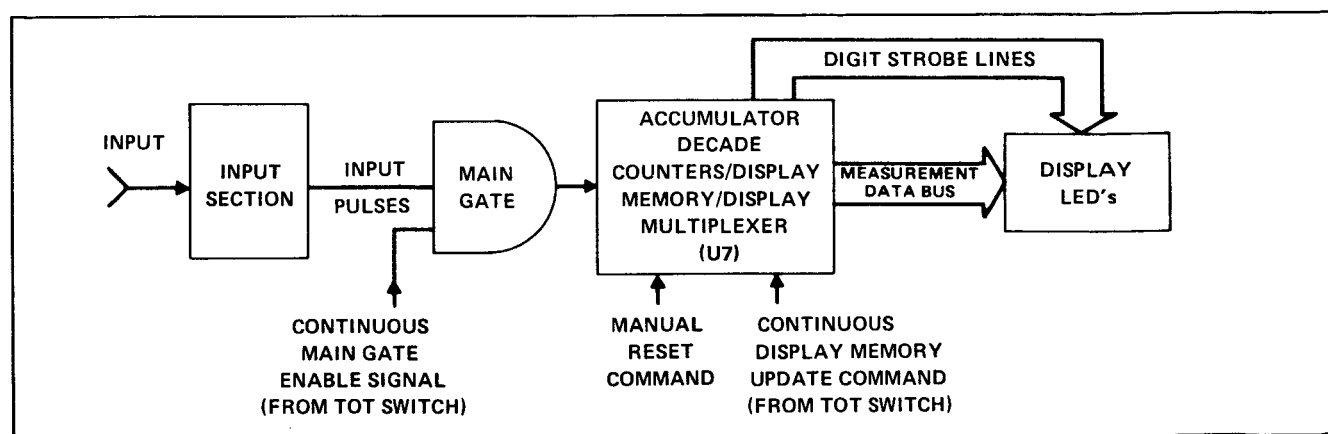


Figure 3-5. Totalize Mode

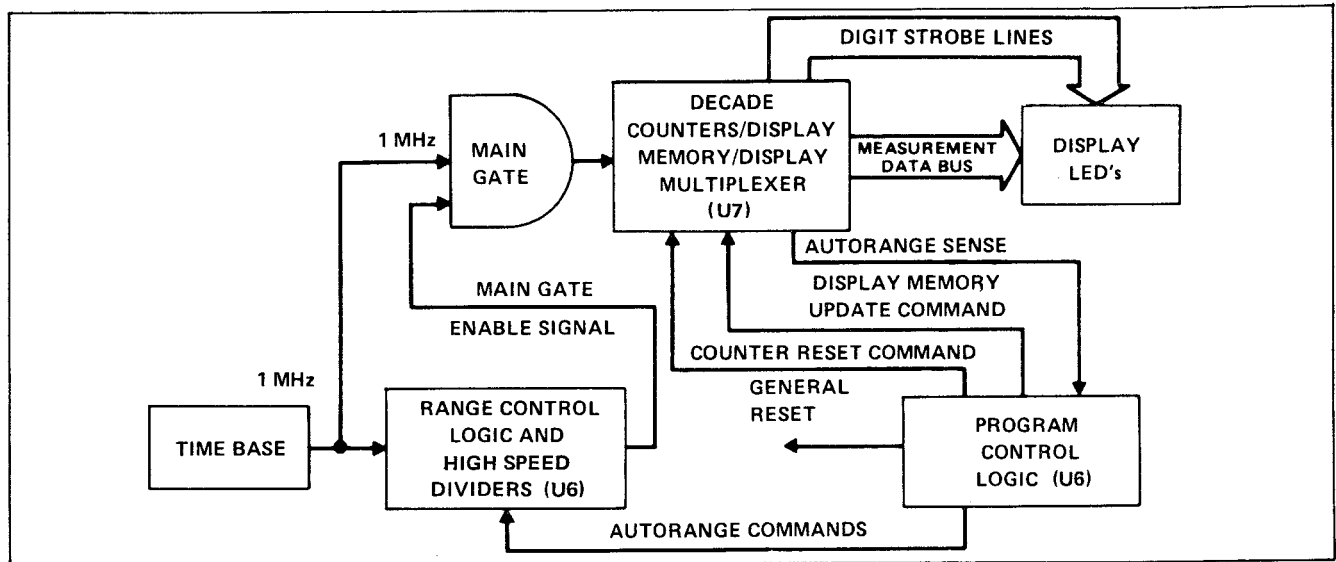


Figure 3-6. Self Check Mode

### 3-26. Input Section, Channel A

3-27. An input signal from the BNC connector (see Figure 3-7) is coupled through C1 to buffer amplifier, Q1. The signal is then applied to the custom IC U1, which includes in part a broadband amplifier, schmitt trigger, and output amplifiers. Attenuator switch S13, when depressed, decreases the gain to attenuate the signal and allow only one tenth of the amplitude of the input to pass. The first section of U1, the broadband amplifier provides gain over the wide range of input frequencies. The second section is a schmitt trigger used to square the output to obtain fast clean transitions. The third section, the output amplifiers, translate the input signal to the standard ECL and TTL levels.

### 3-28. Input Section Channel B (1911A Only)

3-29. For channel B inputs (Figure 3-8) the signal is amplified and fed to a high speed dual flip-flop where it is divided by 2 to bring it within the range of the high speed dividers. The prescaler also contains a level detector

which blocks the prescalers operation when the input levels drop below a preset value. The manual selection of the B channel simultaneously inputs a prescaler code to the controller, U6. This code will cause the controller to double the gate time to compensate for the reduction of the input frequency by the prescaler.

### 3-30. Main Gate High Speed Dividers

3-31. At step-3 in the controllers logic a gate pulse is generated (GATE) and applied to the J and K inputs of the main gate (U2), See Section 8. The input signal is applied to the clock input of the main gate. The ECL output of U2 is translated to a TTL signal by Q4, Q5 and Q6 and applied to the clock input of the next high speed divider (U3B and U4A). The output of the first divider is applied to U7 on four BCD lines, A, B, C, and D. The D output is also applied to the next divider (U8). The rest of the dividers are contained in the display memory and multiplexer (U7), discussed later in this section.

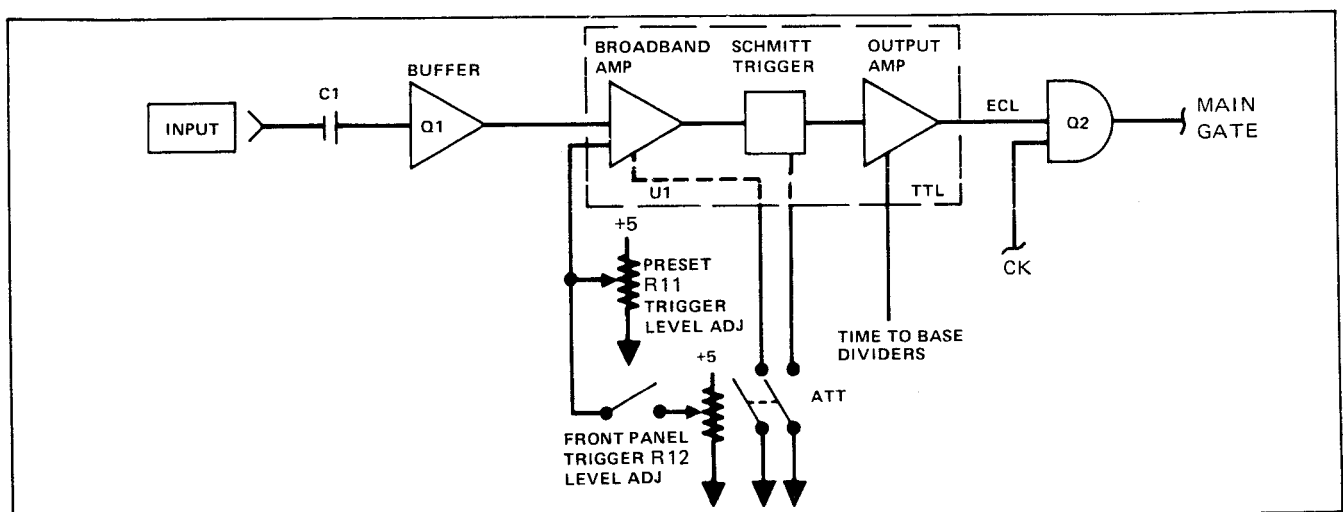


Figure 3-7. Input Section Channel A



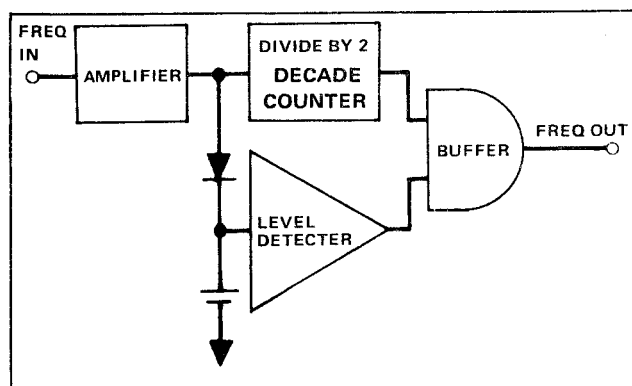


Figure 3-8. Input Section Channel B (1911A Only)

### 3-32. Time Base

3-33. The time base consists of a 10 MHz crystal (Y1), counter (U9). A schematic for this circuit can be found in Section 8. The time base is configured as a colpitts oscillator whose frequency is controlled by the crystal Y1. Buffer amplifier, Q7, drives the NOR gate, U5 which provides further buffering. The decade counter divides the 10 MHz output frequency to obtain the 1 MHz output from the decade counters is applied to the high speed dividers of the range control. In the period and self check modes the 10 MHz output from the time base is applied to the main gate.

### 3-34. Decimal Point Logic

3-35. This multi-counter uses a scheme to position the decimal which is synchronous with the appropriate digit strobe. An encoded input generated by the selection of a range (see Table 3-2 Range Encoding) will enable one of six possible AND gates contained within U6. A decimal positioning strobe (DP) will then be produced by U6 simultaneously with one of the six digit strobes (see Section 8) which will light the appropriate decimal. If autoranging has been selected the encoded range data input to the AND gates within U6 will change as the value of the signal being measured changes. Effectively, this allows the decimal position to shift and compensate for the change in range. The annunciators; kHz/usec, and MHz/msec, are lit by the same scheme used to position the decimal.

### 3-36. Range Control Logic (Frequency A Mode)

3-37. Selection of a range may be determined manually by one of the front panel range switches, or automatically by selecting the autorange mode. If the range is manually selected a range command (see Table 3-2) will be applied to U6. A division ratio of the 1MHz input (U6 pin 12) will be determined by the decade counters contained within U6 (See Section 8.) This division of the 1 MHz signal will effectively set the gate time by controlling the clocking of the main gate, with the GATE signal. The same scheme is used when the autorange mode is selected; however, in this case the range code is not a set output. The range code in

autorange mode will change causing the division of the 1 MHz signal to change, which in turn will enable the gate time to increase or decrease depending upon the value of the signal being measured.

Table 3-2. Range Encoding (Frequency)

INPUT TO RANGE SWITCH ENCODING a) FREQUENCY A MODE					
Input to U6 Pin			Gate Time	Decimal Location Output	Annunciated Units Output
22	23	24			
0	1	0	10 msec*	D5	MHz
1	1	0	0.1 sec*	D3	KHz
0	0	1	1.0 sec*	D4	KHz
1	0	1	10 sec	D5	KHz
1	1	1	Autorange	■	■

\*Obtainable gate times in autorange mode.

■ Not a fixed value.

### 3-38. Range Control Logic (Frequency B Mode 1911A Only)

3-39. The 1911A uses the same manual and autorange logic as the 1910A; however, because of prescaler is used to divide the channel B frequency by two, it is necessary to double the gate time. The increase in gate time is accomplished by dividing the 1 MHz input by 2.

### 3-40. Range Control Logic (Period Mode)

3-41. The range control logic for the period mode is the same as that of the frequency mode, except that the 1 MHz clock input is replaced with the channel A input (XA), See Section 8. XA signal is then divided by the decade counters within U6, the division ratio is again determined by the range selection. (See Table 3-3.) The divided XA signal is then applied to the main gate and used as the enable signal to allow the counting of the 10 MHz time base output.

Table 3-3. Range Encoding (Period)

INPUT TO RANGE SWITCH ENCODING (PERIOD MODE)					
Input to U6 Pin			Gate Time	Period	Annunciated Units Output
22	23	24			
0	0	0	■	10 <sup>0</sup>	msec
1	0	0	■	10 <sup>1</sup>	msec
0	1	0	■	10 <sup>2</sup>	μsec
1	1	0	■	10 <sup>3</sup>	μsec
0*	0*	1*	■	10 <sup>4</sup>	μsec
1	1	1	■		

\* Obtainable only in the period mode of operation when using the autorange resolution.

■ Not a fixed value.

### 3-42. Autorange Logic

3-43. When the autorange mode is selected the range input lines (U6 pins 22, 23, and 24) are replaced by circuits internal to U6 which will select the gate time that will provide the highest resolution possible (See Table 3-3 for the autorange encoding in the period mode, and Table 3-2 for the autorange encoding in the Frequency A mode.)

### 3-44. Display Memory And Multiplexer

3-45. When step-7 is reached, (in the controller's logic) the controller generates a memory update signal (MUP) (see Figure 3-9). At this time the contents of the decade counters are shifted into a series of four bit latches. A 10 kHz oscillator and a 10 stage ring counter inside U7 generate strobe signals used by the display multiplexer. The gates are

sequentially enabled by the strobe signals to apply the contents of the four bit latches onto the common display data bus. Information on this data bus is decoded by a seven segment decoder for application to the display.

### 3-46. Display

3-47. The display section (see Figure 3-10) consists of seven, seven segment LED's each containing its own decimal point. The appropriate LED is enabled simultaneously with the enabling of a gate in the display multiplexer. This allows the digit information to be applied via a common data bus to all LED's. However, only the LED that is enabled by the gate within the display multiplexer will accept the data and light.

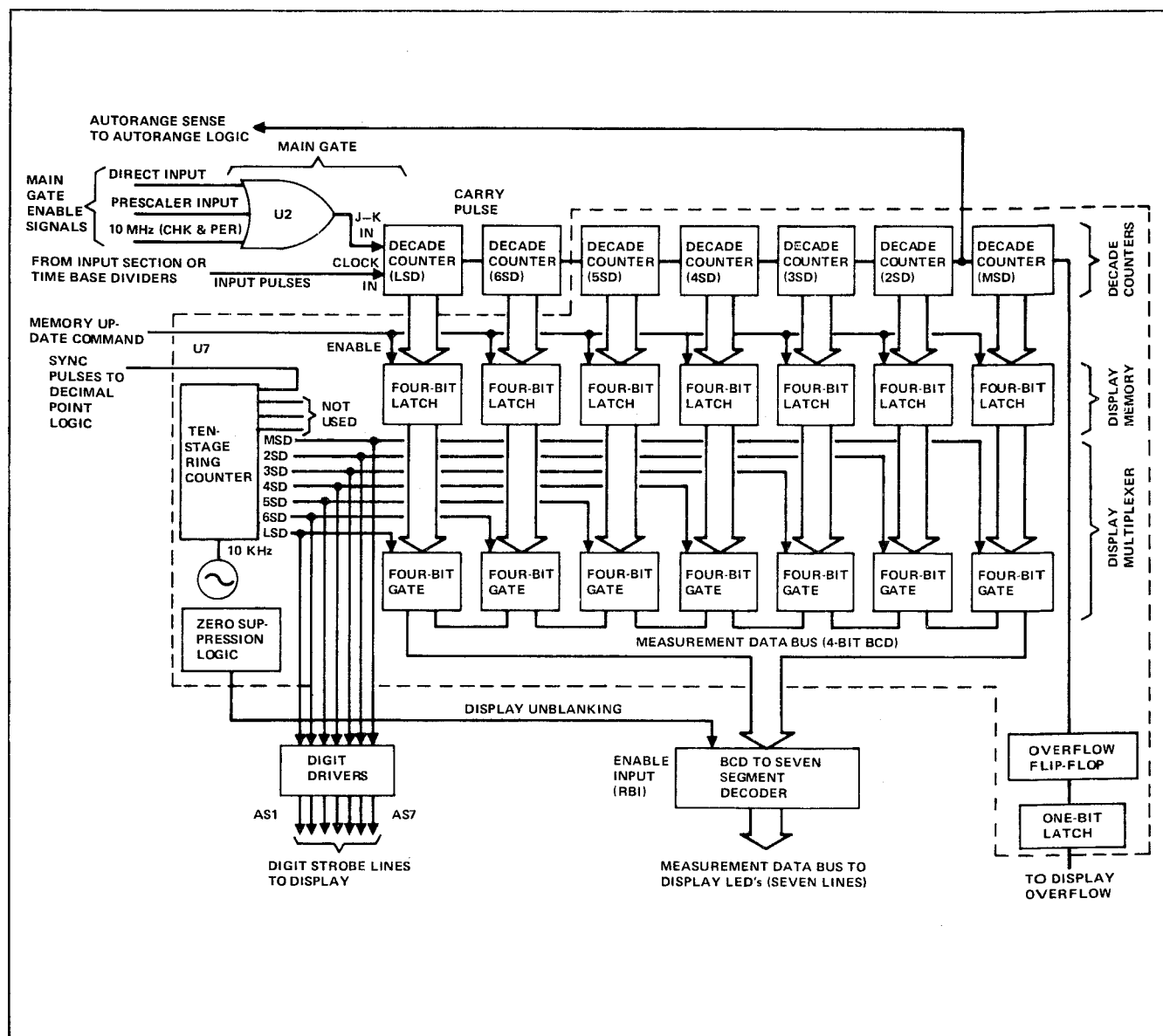


Figure 3-9. Display Memory and Multiplexer

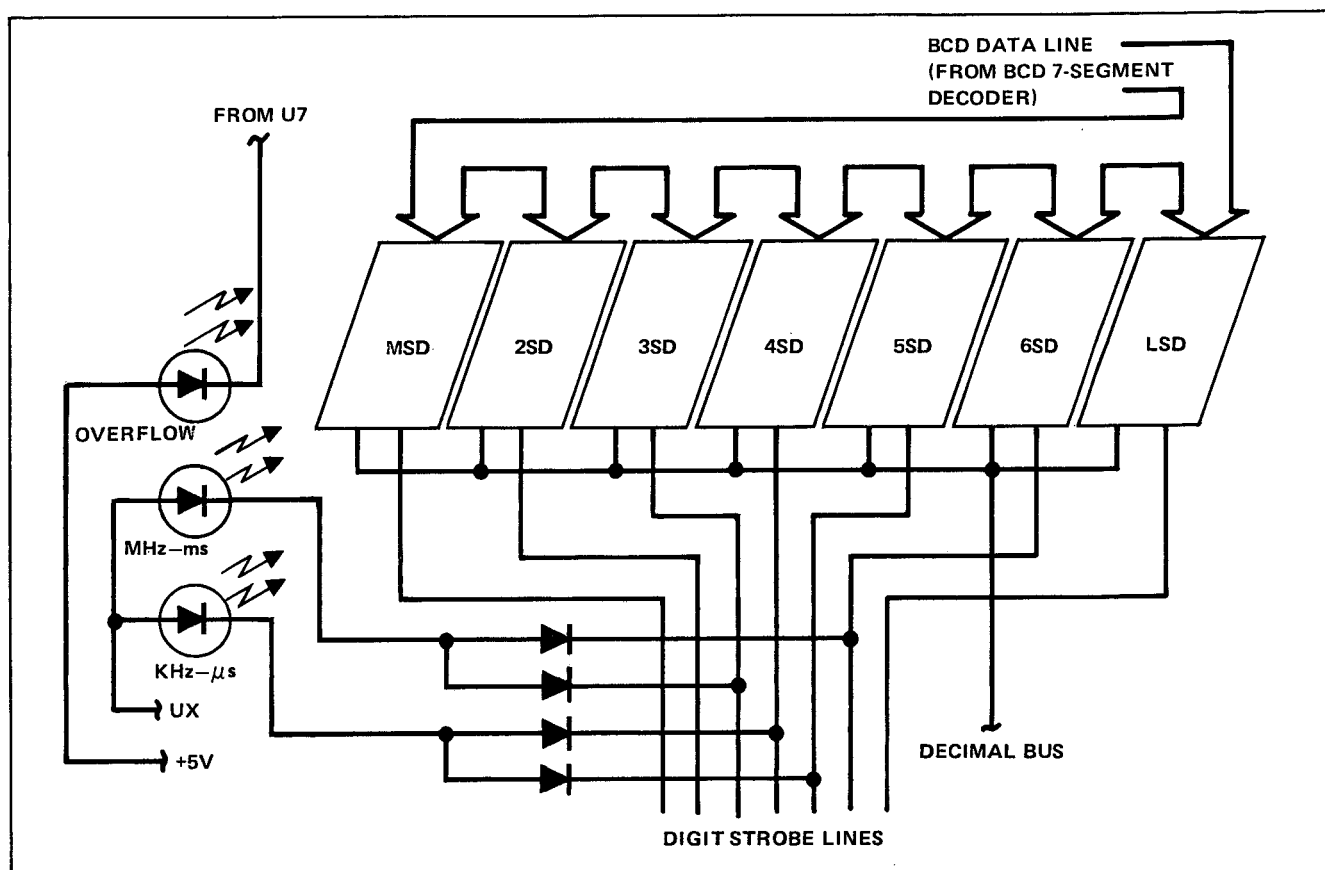


Figure 3-10. Display

## Section 4

# Maintenance

### WARNING

**THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.**

#### 4-1. INTRODUCTION

4-2. This section contains information concerning preventive maintenance for the Model 1910A and 1911A multi-counters. Both instruments are designed to meet or exceed the rated specifications under normal operation for a period of one year. Equipment for performing specification test and calibrating adjustments are listed in Table 4-1. If this equipment is not available, other equipment having equivalent specifications may be used.

#### 4-3. SERVICE MAINTENANCE

4-4. Should your instrument need repair, send it to the nearest authorized service center. A list of these authorized service centers is located in Section 7.

#### 4-5. GENERAL MAINTENANCE

##### 4-6. Access

4-7. Use the following procedure to gain access to the interior of the multi-counter.

1. With the power switch in the off position (out), disconnect the line cord, external clock input, and DOU connection (if used).
2. Remove the phillips screw on rear panel, directly below the line connector.
3. Hold rear of instrument case firmly and pull front panel straight out.

Table 4-1. Required Test Equipment

EQUIPMENT NOMENCLATURE	MINIMUM SPECIFICATIONS	RECOMMENDED EQUIPMENT
Quartz oscillator frequency standard with 20 MHz output.	$1 \times 10^{-8}$ ppm stability	HP 105A/B
Low frequency oscillator	5 Hz to 10 MHz 5 mV to 500 mV	Fluke 6010
High Frequency oscillator	10 MHz to 250 MHz 5 mV to 500 mV	Wave Tek 2001
RF Millivoltmeter with $50\Omega$ terminator, + high impedance terminator	5 mV sensitivity 10 kHz to 250 MHz	Boonton 92B
Multimeter	Greater than 200 mV sensitivity	Fluke 8000A
Oscilloscope	Greater than 100 mV/div.	Tek 465

4. Top and bottom shield may be removed by six # 2-56 screws.
5. All replaceable parts are now visible and may easily be maintained.
6. Reassemble in the opposite order.

#### 4-8. Cleaning

##### CAUTION!

**If any solvent is used, such as freon, it should be kept clear of switches, potentiometers, transformer windings and plastics, since it removes lubrication and breaks down winding insulation.**

- 4-9. Periodically clean the multi-counter to remove accumulated dust, grease, and other contaminants using the following procedure:
  1. Clean the front panel and exterior surfaces with anhydrous ethyl alcohol or soft cloth dampened with a mild solution of detergent and water.
  2. If cleaning of the interior is necessary use clean, dry air at low pressure (20 psi). If contaminants remain individual pcbs can be cleaned using warm water, however, any items likely to be affected by the water (batteries, etc.) should be removed first. Excess water should be blown free with the clean dry air followed by a thorough drying. Do not use drying temperatures in excess of 59°C.

#### 4-10. Fuse Replacement.

4-11. The input power fuse, F1 is located on the rear panel (See Figure 2-1). If replacement is necessary, use an AGC 1/8 amp fast blow for 100 and 115V, a 1/16 amp

fast blow for 230 volt input, and an 1/2 amp slow blow for battery operated units.

#### 4-12. PERFORMANCE TEST

4-13. The performance test is used to compare the sensitivity of the instrument with the list of specifications in Table 1-3. These tests are suitable for incoming inspection, periodic maintenance and to verify overall operation. If the instrument fails to meet any of these checks, repair or calibration is required.

#### 4-14. Initial Procedure Check

4-15. The following conditions must be met before proceeding to the performance test.

1. All external inputs must be made via a shielded cable with a compatible BNC connector.
2. External clock switch must be in internal position.
3. Trigger level must be in the preset position.
4. Attenuator switch should be in the out position.
5. Unit to meet the following checks (See Table 4-2).

#### 4-16. Sensitivity Check (Channel A)

##### NOTE

*The Wavetek generator is an analog frequency selectable device whose output is directly proportional to the accuracy of the adjustments made by the operator.*

1. Connect the low frequency generator set to 10 Hz at 15 mV to the channel A input. If using the 6010A or 6011A signal generators terminate their outputs in 50Ω.

Table 4-2. Initial Procedure Check

FUNCTION	RESOLUTION	DISPLAY	ANNUNCIATORS
FREQ CH A/CH B	100 Hz	0.0000	MHz
FREQ CH A/CH B	10 Hz	0.00	kHz
FREQ CH A/CH B	1 Hz	0.000	kHz
FREQ CH A/CH B	0.1 Hz	0.0000	kHz
PER	0.1 Hz	0.0000	μs
PER	1 Hz	0.000	μs
PER	10 Hz	0.00000	ms
PER	100 Hz	0.0000	ms
CHK	100 Hz	10.0000	MHz
CHK	10 Hz	10000.00	kHz
CHK	1 Hz	0000.000	kHz Overflow
CHK	0.1 Hz	000.0000	kHz Overflow
CHK	AUTO	10000.00	kHz
CHK & RESET	AUTO	88888.88	kHz
TOT	AUTO	0	

2. Energize the counter and select the frequency channel A function and auto resolution.
3. Confirm that the display reads 0.010 kHz  $\pm 1$  digit.
4. Disconnect the low frequency generator and connect a high frequency source terminated in a 50 $\Omega$  at a T-connector on the A channel input. Also connect a RF millivolt meter to the T-connector.
5. Refer to Table 4-3 and set the generator for 150 mV at about 10 MHz to obtain a reference reading. Now lower the generator level until the counter's display changes. Verify that the level at which the display changes is below 15 mV.

Table 4-3. High Frequency Sensitivity Check (Channel A)

GENERATOR SETTING		DISPLAY READING $\pm$ GENERATOR STABILITY
FREQUENCY	LEVEL RMS	
10 MHz	15 mV	10000.00 kHz
50 MHz	15 mV	50000.00 kHz
100 MHz	15 mV	100.0000 MHz
125 MHz	25 mV	125.0000 MHz

6. Repeat Step 5 for each frequency listed in Table 4-3. Note that at 125 MHz the level must be below 25 mV before the display changes.

#### 4-17. Sensitivity Check Channel B (1911A only)

1. Connect the high frequency generator and an R.F. millivoltmeter to the channel B input via a high impedance T-connector.
2. Set the generator to about 50 MHz at 150 mV.
3. Energize the counter and depress the frequency B function switch; select 100 Hz resolution.
4. Make a note of the display reading & reduce the level of the generator until the display goes to zero. The level at which the drop out occurs should be less than 15 mV.
5. Repeat Step 4 at 100 MHz and 175 MHz.
6. Repeat Step 4 at 200 MHz and 250 MHz noting the dropout level is less than 30 mV.

#### 4-18. CALIBRATION

- 4-19. The multi-counter should be calibrated once a year or whenever a sensitivity or accuracy check indicates that the instrument does not meet the specifications. Calibration

requires no more than the adjustment of the trigger level, time base oscillator frequency, and the drop out level for the 1911A channel B (threshold adjustment).

#### 4-20. Trigger/Hysteresis Level Adjustment (Channel A)

- 4-21. The trigger level adjustment should be performed whenever repairs have been made to the input section of the counter. Perform the trigger/hysteresis level adjustment as follows:

1. Remove the instrument from its case.
2. Connect the high frequency generator and an RF millivoltmeter via a T-connector terminated into 50 $\Omega$  to the channel-A input, energize counter.
3. Set the front panel trigger level control to the preset position.
4. Set the generator to 75 mV output level at about 100 MHz, note the display reading as a reference.
5. Set the hysteresis trimpot (R20) to its maximum clockwise position.
6. Reduce the input level until the display becomes unstable and then try to adjust R11 (internal trigger level, see Figure 4-1) for the reference reading as noted in step-4.
7. Repeat step-6 until no additional sensitivity is possible.
8. Repeat sensitivity check channel-A. If counter does not meet this check turn the hysteresis trimpot (R20) counter-clockwise until all display limits as listed in Table 4-3 are met.

#### 4-22. Threshold Adjustment (Channel B 1911A)

1. Remove counter from case.
2. Set function switch to frequency channel B and resolution to 100 Hz.
3. Connect a high frequency generator to a T-connector to the B channel input. Also connect an RF millivoltmeter to the T-connector.
4. Set the generator to about 250 MHz at 25 mV.
5. Set threshold trimpot (R310) on prescaler PCB to maximum counter clockwise position (see Figure 4-1).
6. Advance the trimpot (R310) clockwise until the display goes to zero. Then slowly advance the trim-

4-4

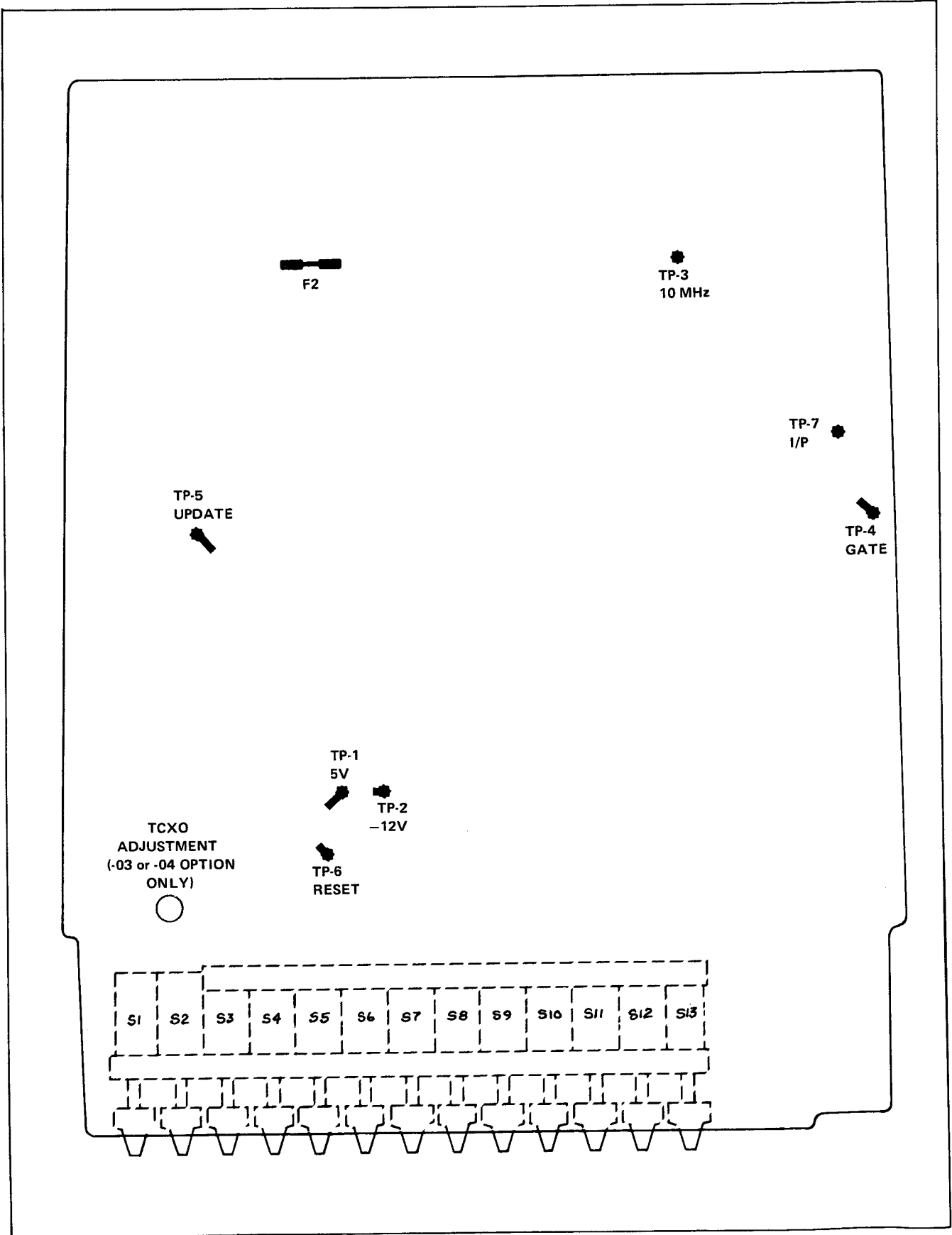


Figure 4-2. Main PCB (BOTTOM VIEW)



pot counter clockwise until the display reads correctly.

7. Reduce the input level and verify that the reading remains good to an input level less than 30 mV.
8. Change the signal generator to 50 MHz and about 100 mV. Reduce the input level and verify that the display reading remains good to below 15 mV. If not readjust R310.
9. The correct adjustment for R310 is for a clean drop out of readings when the level is about 10 mV for frequencies to 175 MHz and about 25 mV at higher than 175 MHz.

#### 4-23. Time Base Adjustment (Standard Unit)

1. Allow the counter to operate for at least 30 minutes in the case to stabilize the internal temperature.
2. Energize the counter and select the FREQ function and 1 Hz resolution.
3. Select a 10 MHz output on the quartz oscillator and connect the 10 MHz signal to the counter input.
4. While observing the counter display, adjust the time base oscillator control (C5 located on the rear panel (see Figure 4-1) to obtain a reading of 000000  $\pm 5$  digits.

#### 4-24. Time Base Calibration (Option -03 and -04)

1. Allow the counter to operate for at least 30 minutes in the case to stabilize the internal temperature.
2. Remove the instrument from the case and immediately reconnect line cord.
3. Select the channel A function at .1 Hz resolution.
4. Connect the 10 MHz reference frequency to the channel A input.
5. Using a nonconductive screwdriver adjust the TCXO through the main PCB (see Figure 4-2) to obtain a reading of overflow 000.0000 Hz  $\pm 3$  digits for the -03 and -04 Options.

#### 4-25. TROUBLESHOOTING

4-26. The following discussion shall be used to isolate and correct any problems still existing after completion of the sensitivity and calibration procedures, for explanation of the symbols used see Figure 4-3. The entirety of the troubleshooting procedure for the instrument is contained within two sections. The first section (Figure 4-4) details a

self-check operation that covers all sections of the counter other than the amplifier U1. The second section (Figure 4-5) completes the troubleshooting procedure by systematically checking U1.

#### NOTE

Typical ECL, TTL levels are as follows:

ECL logic 1 = 4.1 V

logic 0 = 3.2 V

TTL logic 1 = 2.5 V

logic 0 = 0.6 V

#### NOTE!

Test points are clearly marked on the bottom of the main PCB with a number and a star, see Figure 4-2.

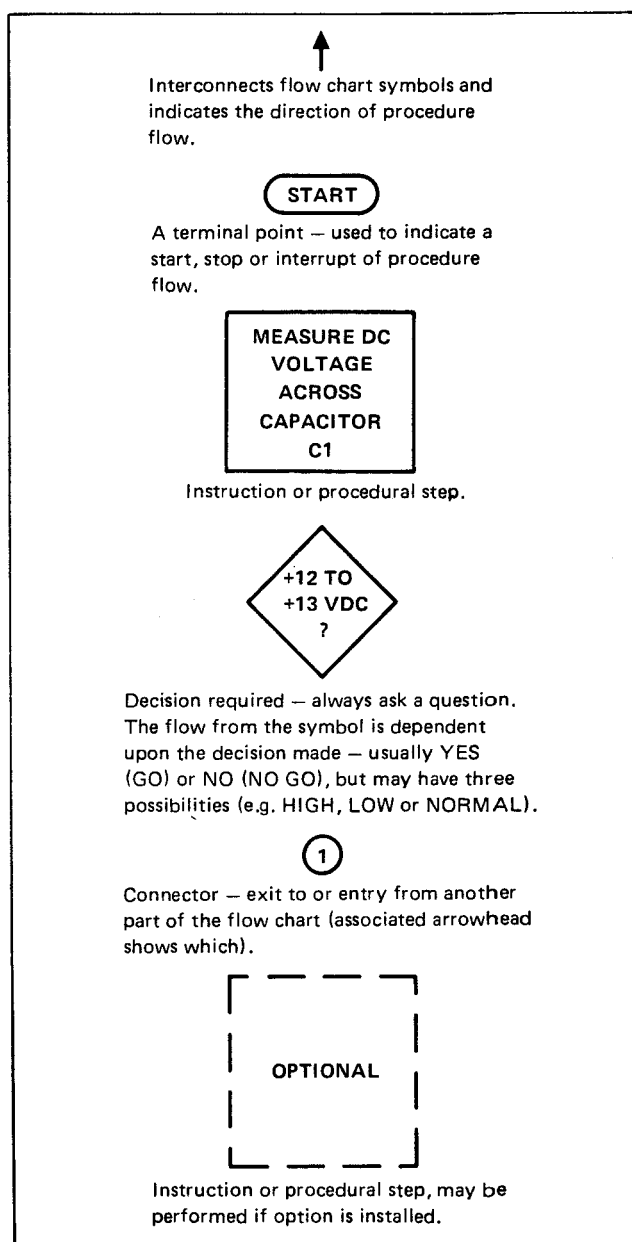


Figure 4-3. Troubleshooting Flow Chart Symbols

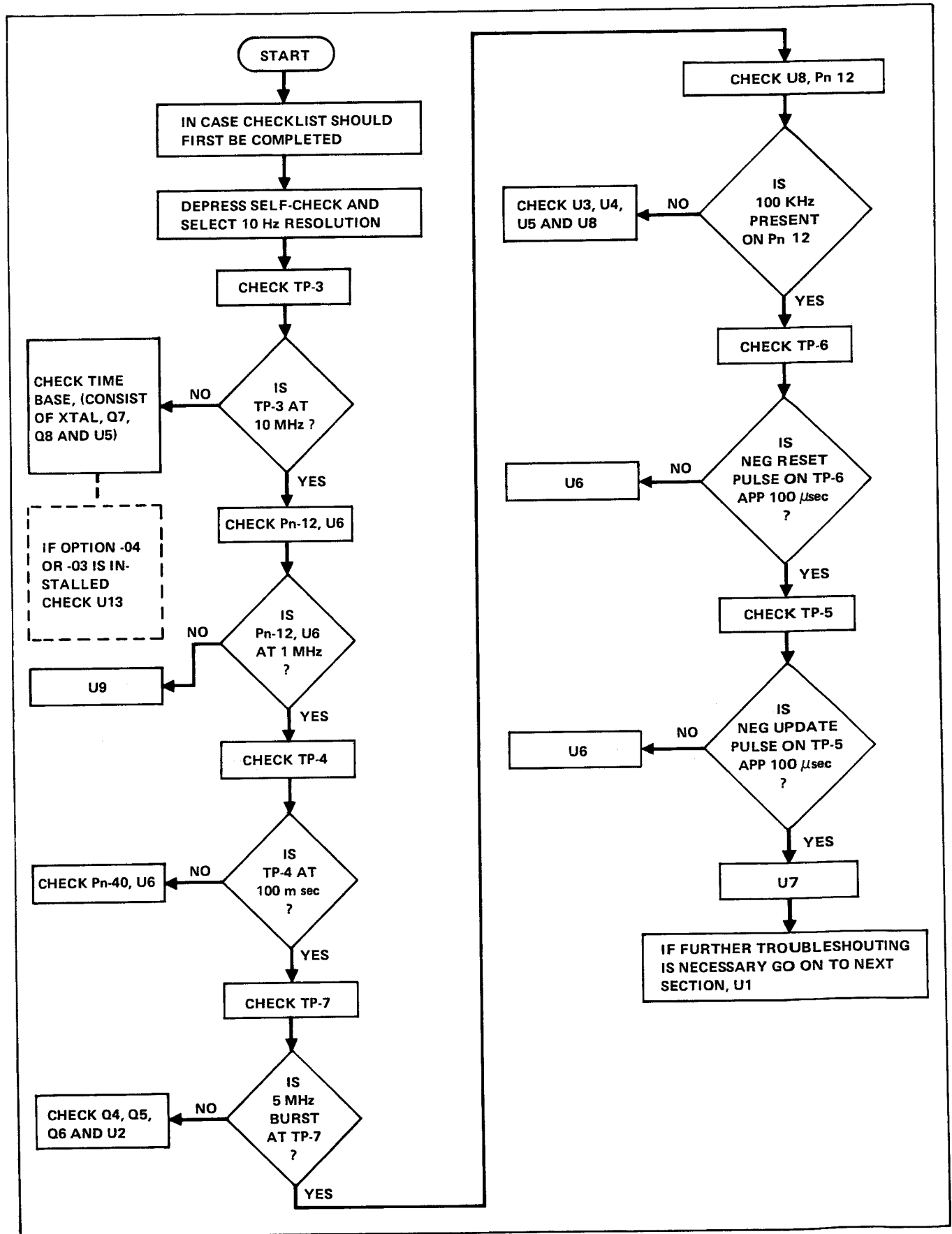


Figure 4-4. Troubleshooting Flow Chart Self Check

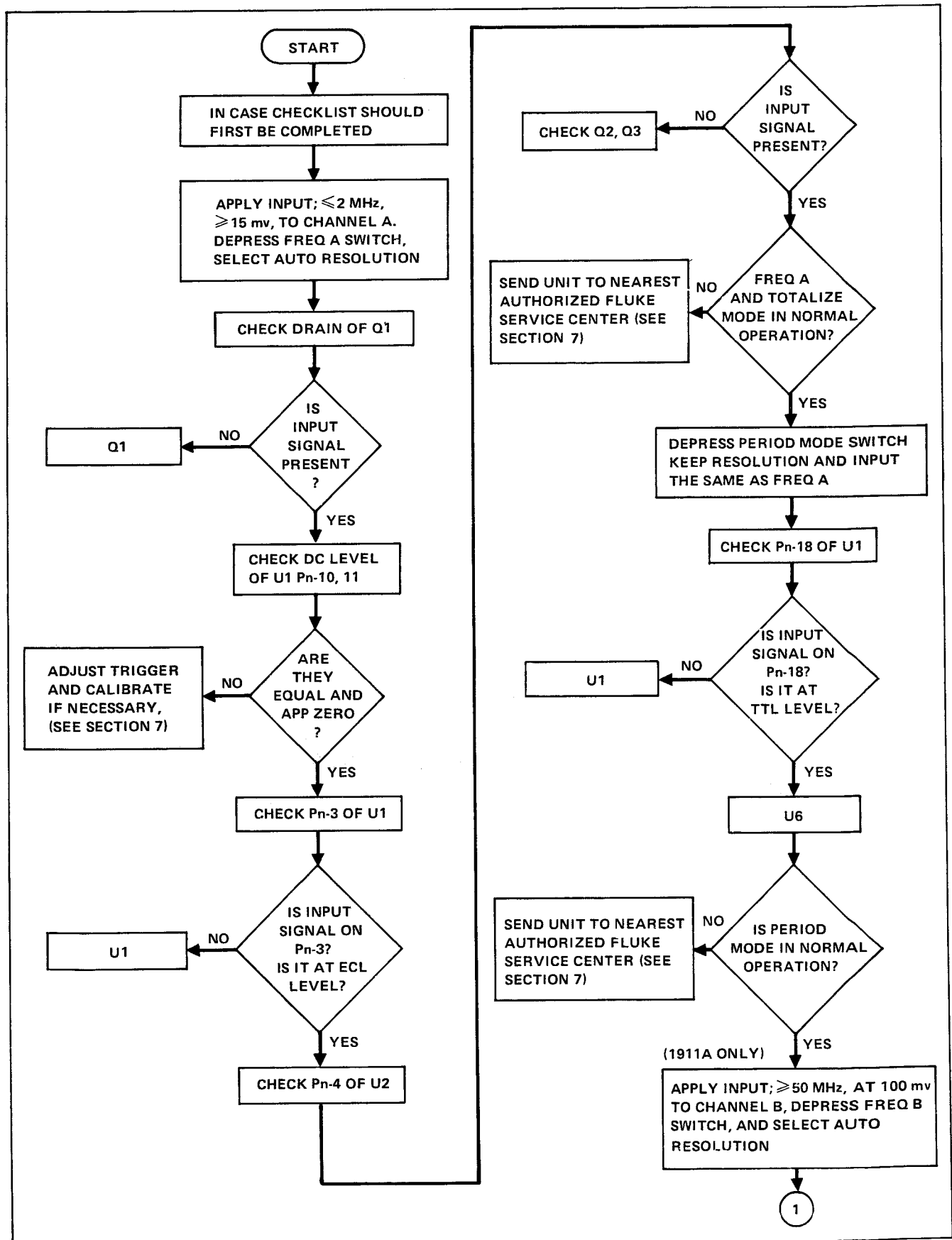


Figure 4-5. Troubleshooting Flow Chart U1

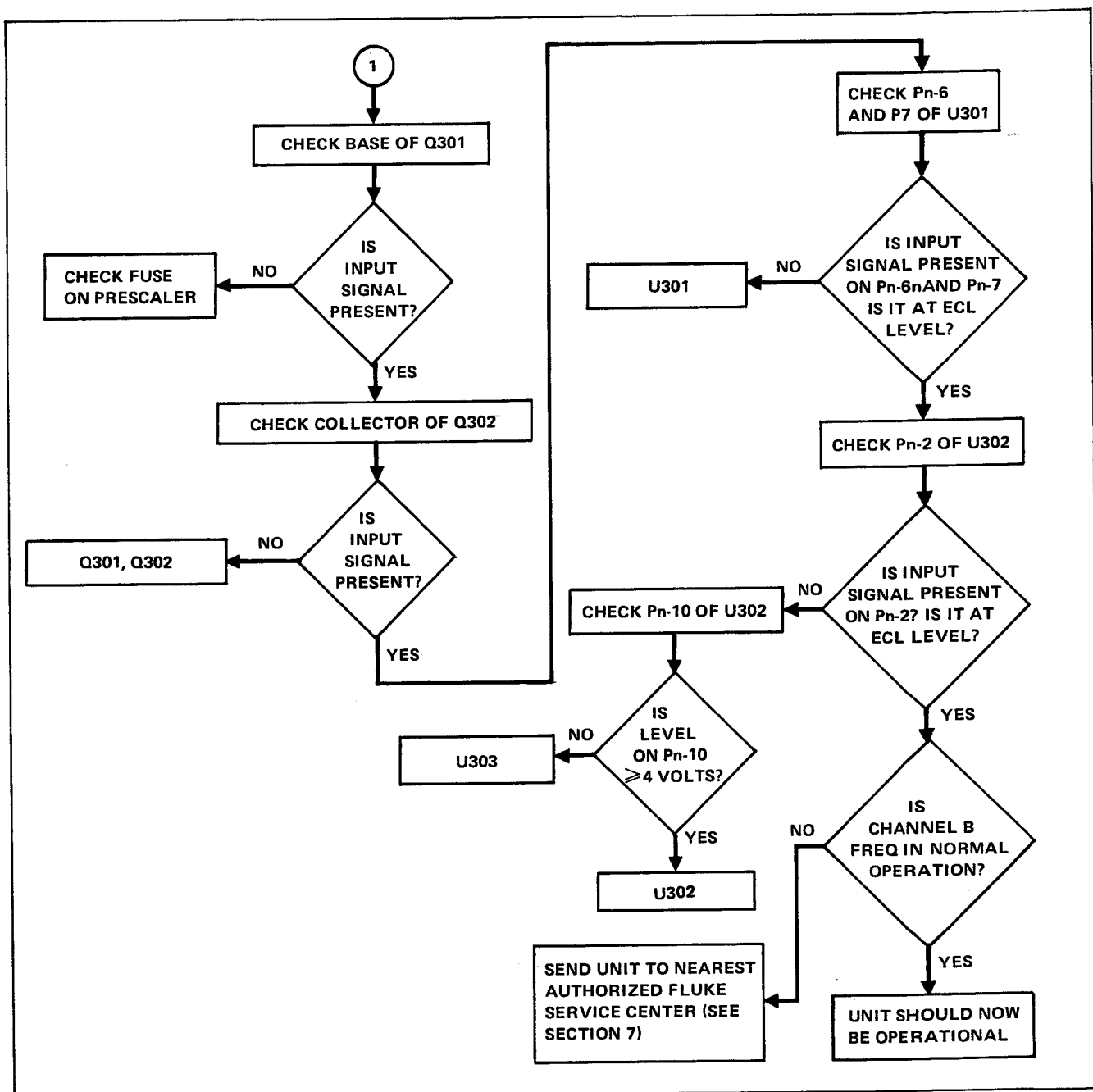


Figure 4-5. Troubleshooting Flow Chart U1 (Concluded)

Section 5

List of Replaceable Parts

NOTE

Unless otherwise specified all parts, drawings, and general information contained in this section pertains to both the Model 1910A and 1911A multi-counters.

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## 5-1. INTRODUCTION

5-2. This section contains an illustrated parts breakdown of the instrument. Components are listed alphabetically by assembly. Electrical components are listed by item number. Each listed part is shown in an accompanying illustration.

5-3. Parts lists include the following information:

1. Reference Designation or Item Number.
2. Description of each part.
3. Fluke Stock Number.
4. Federal Supply Code for Manufacturers.  
(See Section 7 for Code-to-Name list.)
5. Manufacturer's Part Number or Type.
6. Total Quantity per assembly or component.
7. Recommended Quantity: This entry indicates the recommending number of spare parts necessary to support one to five instruments for a period of two years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for one year or more at an isolated site, it is recommended that at least one in each assembly in the instrument be stocked. In the case of optional sub-assemblies, plug-ins, etc., that are not always part of the instrument, or are deviations from the

basic instrument mode, the REC QTY column lists the recommended quantity of the item in that particular assembly.

## 5-4. HOW TO OBTAIN PARTS

5-5. Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. factory or authorized representative by using the **FLUKE STOCK NUMBER**. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

5-6. To ensure the prompt and efficient handling of your order, include the following information:

1. Quantity.
2. **FLUKE** Stock Number.
3. Description.
4. Reference Designation or Item Number
5. Printed Circuit Board Part Number.
6. Instrument Model and Serial Number.

### CAUTION!

⊗ Indicates devices are subject to damage by static discharge.

Table 5-1. 1910A/1911A Final Assembly, Line Power

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	⊗ 1910A/1911A FINAL ASSY, LINE POWER FIGURE 5-1	ORDER	MODEL	1910A OR 1911A			
A1	⊗ MAIN PCB ASSEMBLY (10A/11A-4001)	ORDER	FOR	APPLICABLE SOURCE	1		
F1	FUSE (ORDER FOR APPLICABLE SOURCE)	NOT	SHOWN				
	FUSE, 1/8 AMP (100V & 115V SOURCE)	166488	71400	MDL1-8	1		5
	FUSE, 1/16 AMP S.B. (230V SOURCE)	163030	71400	MDL1-16	1		5
H1	SCREW, PHP, 2-56 X 1/4	149534	89536	149534	6		
H2	SCREW, PHP, 6-32 X 3/8	152165	89536	152165	1		
H3	SCREW, THD, FORMING, 6-20 X 3/8	288266	89536	288266	2		
H4	WASHER, FLAT	340505	89536	340505	2		
H5	WASHER, LOCK, INTRNL TOOTH #2	110676	89536	110676	2		
MP1	BASIC CASE	458331	89536	458331	1		
MP2	FOOT PAD	338632	89536	338632	2		
MP3	HANDLE, MOLDED	330092	89536	330092	1		
MP4	SHEILD, BOTTOM	458869	89536	458869	1		
MP5	SHEILD, TOP	459248	89536	459248	1		
MP6	SPECIFICATION DECAL	429316	89536	429316	1		
MP7	KNOB DECAL	347401	89536	347401	2		
MP8(F1)	FUSE INSERT (FOR ALL SOURCES) NOT SHOWN	460238	89536	460238	1		
U6	⊗ IC, P-MOS (INSTALLED IN TEST)	460063	89536	460063	1		
U7	⊗ IC, MOS (INSTALLED IN TEST)	473215	89536	473215	1		
W1W3W7	JUMPER WIRES, FOR 115V SOURCE (NOT SHOWN)	451278	89536	451278	AR		
W2,W7	JUMPER WIRES, FOR 230V SOURCE (NOT SHOWN)	465237	89536	465237	AR		
W3W1W7	JUMPER WIRES, FOR 100V SOURCE (NOT SHOWN)	451310	89536	451310	AR		
W10	LINE CORD W/INTERNAL CONN (NOT SHOWN)	343723	89536	343723	1		

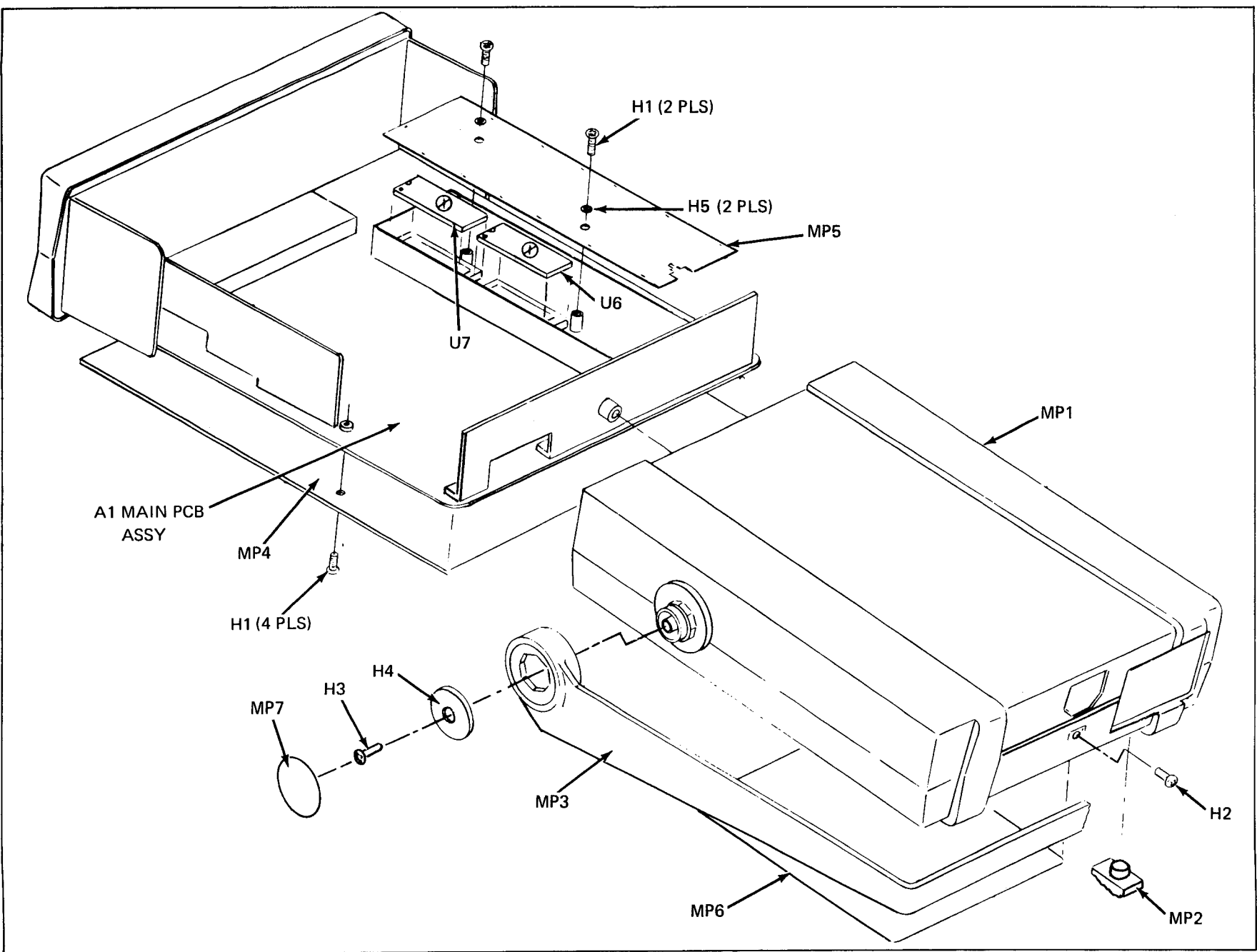


Figure 5-1. 1910A/1911A Final Assembly, Line Power



Table 5-2. A1 Main PCB Assembly, Line Power

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1	⊗MAIN PCB ASSY(10A/11A-4001)FIG. 5-2	ORDER	MODEL	1910A OR 1911A	1		
A1A2	DISPLAY PCB ASSY (1910A-4020T)	ORDER	MODEL	1910A OR 1911A	1		
A1A3	250MHZ PRESCLAER(1910A-4003T) 1911A ONLY	443341	89536	443341	1		
C1	CAP,ELECT,680UF,-10/+50%,25V	218172	73445	ET681X-025A02	1	1	
C2	CAP,ELECT,5000UF,-10/+100%,15V	379370	25088	B41010-5000/15	1	1	
C3	CAP,TA,10UF,+/-20%,15V	193623	56289	196D106X-0015KA1	7		
C4	CAP,CER,0.01UF,+/-20%,100V	149153	56289	C023B101F-103M	6		
C5	CAP,VAR,7 - 25PF,350V	229948	72982	538-006B-7-25	1	1	
C6	CAP,CER,22PF,+/-20%,10KV	369157	72982	831-000-COG0-220	4		
C7	CAP,CER,47PF,+/-20%,1000V	369132	56289	C020B-1024470J	1		
C8	CAP,CER,0.01UF,+/-20%,100V	149153	56289	C023B101F-103M	REF		
C9	CAP,CER,0.001UF +/-10%,1KV	368621	71590	DD-102	1		
C10	CAP,POLYSTYRNE FILM,0.1UF,+/-10%,400V	447573	73445	C280MAF/A100K	1		
C11	CCAP,CER,100PF,+/-10%,1KV	105593	71590	DD101	1		
C12	CAP,CER,22PF,+/-20%,10KV	369157	72982	831-000-COG0-220	REF		
C13	CAP,TA,10UF,+/-20%,15V	193623	56289	196D106X-0015KA1	REF		
C14	CAP,TA,22UF,+/-20%,15V	423012	56289	196D226X-0015KA1	2		
C15	CAP,CER,1000PF,+/-20%,100V	402966	72982	8121-A100-W5R-102M	5		
C16	CAP,TA,10UF,+/-20%,15V	193623	56289	196D106X-0015KA1	REF		
C17	CAP,TA,10UF,+/-20%,15V	193623	56289	196D106X-0015KA1	REF		
C18	CAP,CER,1000PF,+/-20%,100V	402966	72982	8121-A100-W5R-102M	REF		
C19	CAP,TA,10UF,+/-20%,15V	193623	56289	196D106X-0015KA1	REF		
C20	CAP,CER,1000PF,+/-20%,100V	402966	72982	8121-A100-W5R-102M	REF		
C21	CAP,CER,22PF,+/-20%,10KV	369157	72982	831-000-COG0-220	REF		
C22	CAP,CER,1000PF,+/-20%,100V	402966	72982	8121-A100-W5R-102M	REF		
C23	CAP,CER,0.01UF,+/-20%,100V	149153	56289	C023B101F-103M	REF		
C24	CAP,CER,0.01UF,+/-20%,100V	149153	56289	C023B101F-103M	REF		
C25	CAP,CER,0.01UF,+/-20%,100V	149153	56289	C023B101F-103M	REF		
C26	CAP,TA,1UF,+/-20%,15V	161919	56289	196D105X-0035JA1	1		
C27	CAP,CER,0.01UF,+/-20%,100V	407361	72982	812-A100-W5R-103M	1		
C28	CAP,TA,10UF,+/-20%,15V	193623	56289	196D106X-0015KA1	REF		
C29	CAP,CER,0.0012UF,+/-10%,500V	106732	71590	CF122	1		
C30	CAP,TA,22UF,+/-20%,15V	423012	56289	196D226X-0015KA1	REF		
C31	CAP,TA,10UF,+/-20%,15V	193623	56289	196D106X-0015KA1	REF		
C32	CAP,CER,0.01UF,+/-20%,100V	149153	56289	C023B101-F103M	REF		
C33	CAP,CER,1000PF,+/-20%,100V	402966	72982	8121-A100-W5R-102M	REF		
CR1	DIODE,SI,RECTIFIER	343491	04713	1N4002	2	1	
CR2	DIODE,SI,RECTIFIER	343491	04713	1N4002	REF		
CR3	RECTIFIER BRIDGE	296509	09423	FB200	1	1	
CR6	DIODE,HI-SPEED SWITCHING	203323	07910	1N4448	3	1	
CR7	DIODE,HI-SPEED SWITCHING	203323	07910	1N4448	REF		
CR8	DIODE,LO-CAP	381806	07910	1N3062	2	1	
CR9	DIODE,LO-CAP	381806	07910	1N3062	REF		
CR11	DIODE,ZENER,400MW,+/-5%,6.8V	260695	07910	1N754A	1	1	
CR12	DIODE,HI-SPEED SWITCHING	203323	07910	1N4448	REF		
H1	LUG,SOLDER	151431	79963	329	2		
H2	LUG,SOLDER	441972	79963	761	2		
H3	NUT,HEX 4-40,STEEL NICKEL PLATED	110635	73734	8003NP	2		
H4	SCREW,PHP,4-40X1/4	129890	73734	19021	1		
H5	WASHER,INT LOCK,#4	110403	73734	99402	3		
H6	NUT,HEX,1/4-32,BRASS NICKEL PLATED	110601	73734	1/4-32 NEF2B	1		
H7	SCREW,PHP, 3/16 X 6-32, CAD PLATE	381087	89536	381087	2		
J1	CONN,RECEPTACLE,BNC	152033	95712	30355-1	3		
J2	CONN,RECEPTACLE,BNC,ASSEMBLY	152033	95712	30355-1	REF		
J3	CONN, RECEPTACLE, BNC (1911A ONLY)	152033	95712	30355-1	REF		
MP1	CABLE CLAMP (NOT SHOWN)	172080	06383	SST-1M	1		
MP2	DECAL,FRONT PANEL (1910A ONLY)	429324	89536	429324	1		
MP3	DECAL FRONT PANEL (1911A ONLY)	453969	89536	453969	1		
MP4	DECAL,XFRM WARNING (NOT SHOWN)	386250	89536	386250	1		
MP5	KNOB,POINTER	448803	89536	448803	1		
MP6	LENS,FRONT	456582	89536	456582	1		
MP7	PANEL,REAR	443291	89536	443291	1		
MP8	PANEL,FRONT	443283	89536	443283	1		

Table 5-2. A1 Main PCB Assembly, Line Power (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
MP9	SHEILD, WALL	459230	89536	459230	1		
MP10	TERMINAL GUIDES	375840	89536	375840	1		
MP12	CABLE TIE	331157	06383	PLT2M			
MP13	RETANIER	352484	77969	9109-E	2		
MP14	TERMINAL PINS	376574	00779	3-87022-1	3		
MP15	FUSE HOLDER, ASSEMBLY	460329	89536	460329	1		
MP16	TRANSIPAD (NOT SHOWN)	152207	07047	10123-DAP	1		
Q1	XSTR, FET, JUNCTION, N-CHANNEL	288324	89536	288324	1	1	
Q2	XSTR, FET, N-CHANNEL	404277	89536	404277	1	1	
Q3	XSTR, SI, PNP	195974	04713	2N3906	4	1	
Q4	XSTR, SI, PNP	195974	04713	2N3906	REF		
Q5	XSTR, SI, PNP	195974	04713	2N3906	REF		
Q6	XSTR, SI, PNP	195974	04713	2N3906	REF		
Q7	XSTR, NPN	218396	04713	2N3904	5	1	
Q8	XSTR, FET, JUNCTION, N-CHANNEL	386094	89536	386094	1	1	
Q9	XSTR, NPN	218396	04713	2N3904	REF		
Q10	XSTR, NPN	218396	04713	2N3904	REF		
Q11	XSTR, NPN	218396	04713	2N3904	REF		
Q12	XSTR, NPN	218396	04713	2N3904	REF		
R1	RES, DEP CAR, 1K, +/-5%, 1/4W	343426	80031	CR251-4-5P1KT	6		
R2	RES, DEP CAR, 1M, +/-5%, 1/4W	348987	80031	CR25-4-5P1MT	4		
R3	RES, DEP CAR, 2.7K, +/-5%, 1/4W	386490	80031	CR251-4-5P2K7T	3		
R4	RES, DEP CAR, 180, +/-5%, 1/4W	441436	80031	CR251-4-5P180ET	2		
R5	RES, DEP CAR, 560, +/-5%, 1/4W	385948	80031	CR251-4-5P560ET	5		
R6	RES, DEP CAR, 10K, +/-5%, 1/4W	348839	80031	CR251-4-5P10KT	8		
R7	RES, DEP CAR, 1M, +/-5%, 1/4W	348987	80031	CR25-4-5P1MT	REF		
R8	RES, DEP CAR, 150, +/-5%, 1/4W	343442	80031	CR251-4-5P150ET	2		
R9	RES, DEP CAR, 1M, +/-5%, 1/4W	348987	80031	CR251-4-5P1MT	REF		
R10	RES, DEP CAR, 2.7K, +/-5%, 1/4W	386490	80031	CR251-4-5P2K7T	REF		
R11	RES, VAR, CAR, COMP, 10K, +/-20%, 0.2W	369553	54869	PT10V-10K	1	1	
R12	RES/SWITCH, POTENTIOMETER, 10K	443044	89536	443044	1	1	
R13	RES, DEP CAR, 22K, +/-5%, 1/4W	348870	80031	CR251-4-5P-22KT	2	1	
R14	RES, DEP CAR, 150K, +/-5%, 1/4W	348938	80031	CR251-4-5P150KT	1		
R15	RES, DEP CAR, 1.5K, +/-5%, 1/4W	343418	80031	CR251-4-5P1K5T	2		
R16	RES, DEP CAR, 1.5K, +/-5%, 1/4W	343418	80031	CR251-4-5P1K5T	REF		
R17	RES, DEP CAR, 22K, +/-5%, 1/4W	348870	80031	CR251-4-5P-22KT	REF		
R19	RES, DEP CAR, 560, +/-5%, 1/4W	385948	80031	CR251-4-5P560ET	REF		
R20	RES, VAR, CERMET, 10K +/-5%, 1/4W	309674	89536	309974	1		
R21	RES, DEP CAR, 10K, +/-5%, 1/4W	348839	80031	CR251-4-5P10KT	REF		
R22	RES, DEP CAR, 100K, +/-5%, 1/4W	348920	80031	CR251-4-5P100KT	3		
R23	RES, DEP CAR, 1K, +/-5%, 1/4W	343426	80031	CR251-4-5P1KT	REF		
R24	RES, DEP CAR, 1.2K, +/-5%, 1/4W	441378	80031	CR251-4-5P1K2T	1		
R25	RES, DEP CAR, 270, +/-5%, 1/4W	348789	80031	CR251-4-5P270ET	1		
R26	RES, DEP CAR, 220, +/-5%, 1/4W	342626	80031	CR251-4-5P220ET	1		
R27	RES, DEP CAR, 33, +/-5%, 1/4W	414524	80031	CR251-4-5P33ET	1		
R28	RES, DEP CAR, 560, +/-5%, 1/4W	385948	80031	CR251-4-5P560ET	REF		
R29	RES, DEP CAR, 1K, +/-5%, 1/4W	343426	80031	CR251-4-5P1KT	REF		
R30	RES, DEP CAR, 2.7K, +/-5%, 1/4W	386490	80031	CR251-4-5P2K7T	REF		
R31	RES, DEP CAR, 150, +/-5%, 1/4W	343442	80031	CR251-4-5P150ET	REF		
R32	RES, DEP CAR, 1K, +/-5%, 1/4W	343426	80031	CR251-4-5P1KT	REF		
R33	RES, DEP CAR, 560, +/-5%, 1/4W	385948	80031	CR251-4-5P560ET	REF		
R34	RES, DEP CAR, 1K, +/-5%, 1/4W	343426	80031	CR251-4-5P1KT	REF		
R35	RES, DEP CAR, 10K, +/-5%, 1/4W	348839	80031	CR251-4-5P10KT	REF		
R36	RES, DEP CAR, 100K, +/-5%, 1/4W	348920	80031	CR251-4-5P100KT	REF		
R37	RES, DEP CAR, 1M, +/-5%, 1/4W	348987	80031	CR25-4-5P1MT	REF		
R38	RES, DEP CAR, 1K, +/-5%, 1/4W	343426	80031	CR251-4-5P1KT	REF		
R39	RES, DEP CAR, 10K, +/-5%, 1/4W	348839	80031	CR251-4-5P10KT	REF		
R42	RES, DEP CAR, 27, +/-5%, 1/4W	348763	80031	CR251-4-5P27ET	2		
R43	RES, DEP CAR, 27, +/-5%, 1/4W	348763	80031	CR251-4-5P27ET	REF		
R44	RES, DEP CAR, 4.7K +/-5%, 1/4W	348821	80031	CR251-4-5P4K7T	2		
R45	RES, DEP CAR, 4.7K +/-5%, 1/4W	348821	80031	CR251-4-5P4K7T	REF		
R46	RES, DEP CAR, 560, +/-5%, 1/4W	385948	80031	CR251-4-5P560ET	REF		

Table 5-2. A1 Main PCB Assembly, Line Power (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R48	RES, DEP CAR, 180, +/-5%, 1/4W	441436	80031	CR251-4-5P180ET	REF		
R49	RES, DEP CAR, 10K, +/-5%, 1/4W	348839	80031	CR251-4-5P10KT	REF		
R51	RES, DEP CAR, 100K, +/-5%, 1/4W	348920	80031	CR251-4-5P100KT	REF		
R52	RES, DEP CAR, 10K, +/-5%, 1/4W	348839	80031	CR251-4-5P10KT	REF		
R54	RES, COMP, 47 +/-5% 1/4W	147892	01121	CB4705	1		
S1	SWITCH, BUTTON, GREEN	445197	89536	445197	1		
S1 - S13	SWITCH ASSEMBLY	429589	89536	429589	1		
S2	SWITCH, BUTTON, BLUE	445205	89536	445205	1		
S3	SWITCH, BUTTON, DARK GREY	426759	89536	426759	6		
S4	SWITCH, BUTTON, DARK GREY	426759	89536	426759	REF		
S5	SWITCH, BUTTON, DARK GREY	426759	89536	426759	REF		
S6	SWITCH, BUTTON, DARK GREY	426759	89536	426759	REF		
S7	SWITCH, BUTTON, DARK GREY	426759	89536	426759	REF		
S8	SWITCH, BUTTON, LIGHT GREY	425900	89536	425900	5		
S9	SWITCH, BUTTON, LIGHT GREY	425900	89536	425900	REF		
S10	SWITCH, BUTTON, LIGHT GREY	425900	89536	425900	REF		
S11	SWITCH, BUTTON, LIGHT GREY	425900	89536	425900	REF		
S12	SWITCH, BUTTON, LIGHT GREY	425900	89536	425900	REF		
S13	SWITCH, BUTTON, DARK GREY	426759	89536	426759	REF		
S14	SWITCH, SLIDE	354878	95146	MSS22504	1		
S15	SWITCH/POTENTIOMETER	SEE	R12				
T1	XFRM POWER	ORDER	FOR	APPLICABLE SOURCE			
	XFRM POWER, 115/230V SOURCE	463794	89536	463794	1		
	XFRM POWER, 100V SOURCE	463810	89536	463810	1		
U1	IC, WIDEBAND AMP	SEE	FINAL	ASSEMBLY			
U2	IC, DGTL, ECL, EDGE-TRIG JK FLIP-FLOP	402743	12040	F95029DC	1	1	
U3	IC, TTL, DUAL JK FLIP-FLOP (SCHOTTKY)	363440	01295	SN74S112N	2	1	
U5	IC, DGTL, QUAD, 2-INPUT, POS NOR GATES	288845	01295	SN7402N	1	1	
U6	⊗SEE FINAL ASSEMBLY PARTS LIST						
U7	⊗SEE FINAL ASSEMBLY PARTS LIST						
U8	IC, TTL, 50MHZ DECADE COUNTER	320754	01295	SN74196N	1	1	
U9	IC, DGTL, TTL, MSI, DECADE COUNTERS	402545	01295	SN74LS90N	1	1	
U10	IC, DGTL, MOS-TO-LED, HEX/DIGIT/DRIVER	429506	12040	DS75492N	1	1	
U11	IC, LINEAR, V/REGULATOR	429514	07623	79M12HC	1	1	
U12	IC, LINEAR, V/REGULATOR	355107	04713	MC7805CP	1	1	
U15	IC, LINEAR TIMER	402610	12040	LM555CN	1		
W1	CABLE ASSY(1911A ONLY)	450049	89536	450049	1		
XU1	SOCKET, IC, 18-PIN	413229	91506	318-AG39D	1		
XU2	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	3		
XU3	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
XU4	SOCKET, IC, 16-PIN	276535	91506	316-AG39D	REF		
XU6	SOCKET, IC, 40-PIN	386060	09922	DILB40P-1	2		
XU7	SOCKET, IC, 40-PIN	386060	09922	DILB40P-1	REF		
Y1	CRYSTAL, 10MHZ	385732	89536	385732	1		

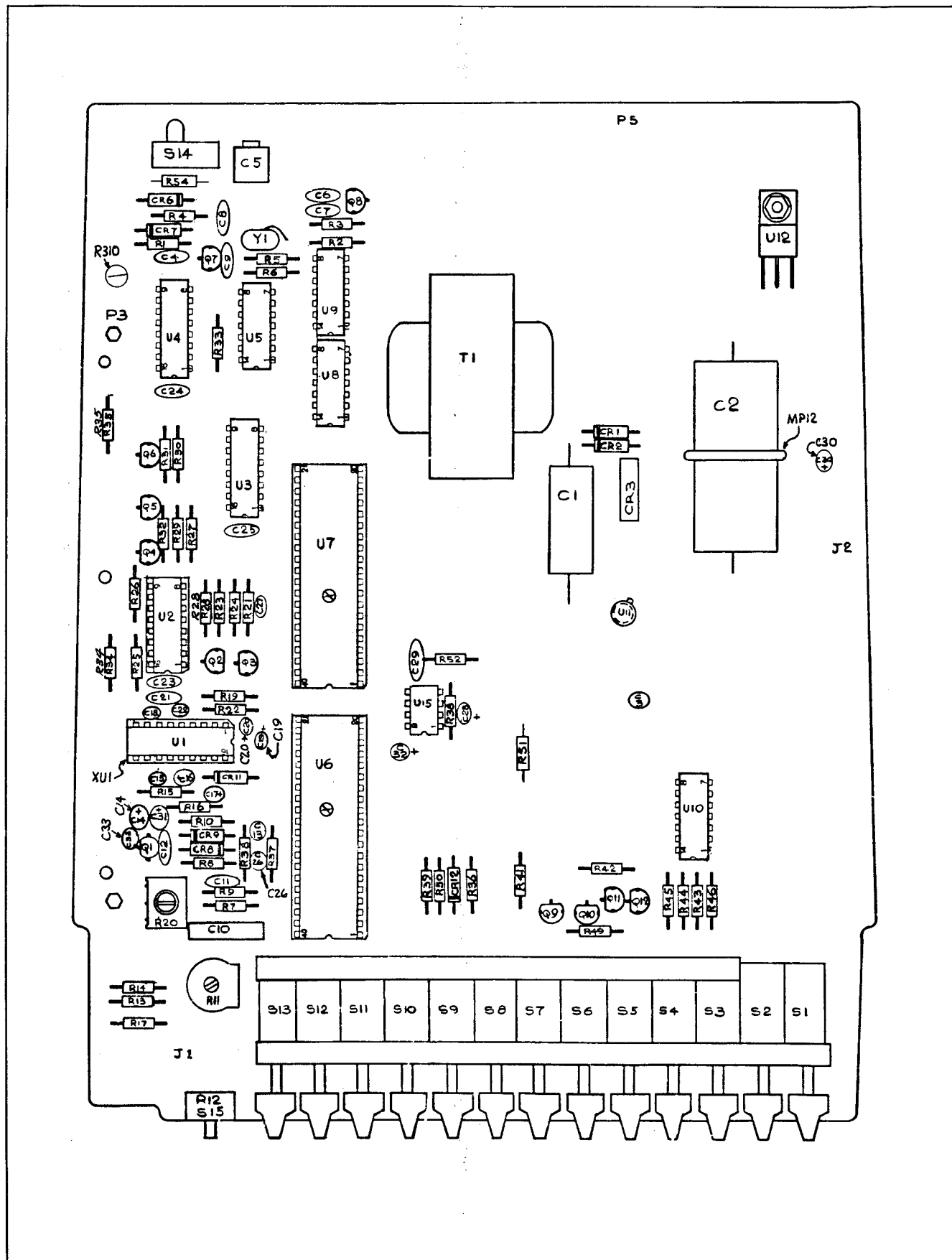


Figure 5-2. A1 Main PCB Assembly, Line Power (Sheet 1 of 2)

Figure 5-2. A1 Main PCB Assembly, Line Power (Sheet 2 of 2)

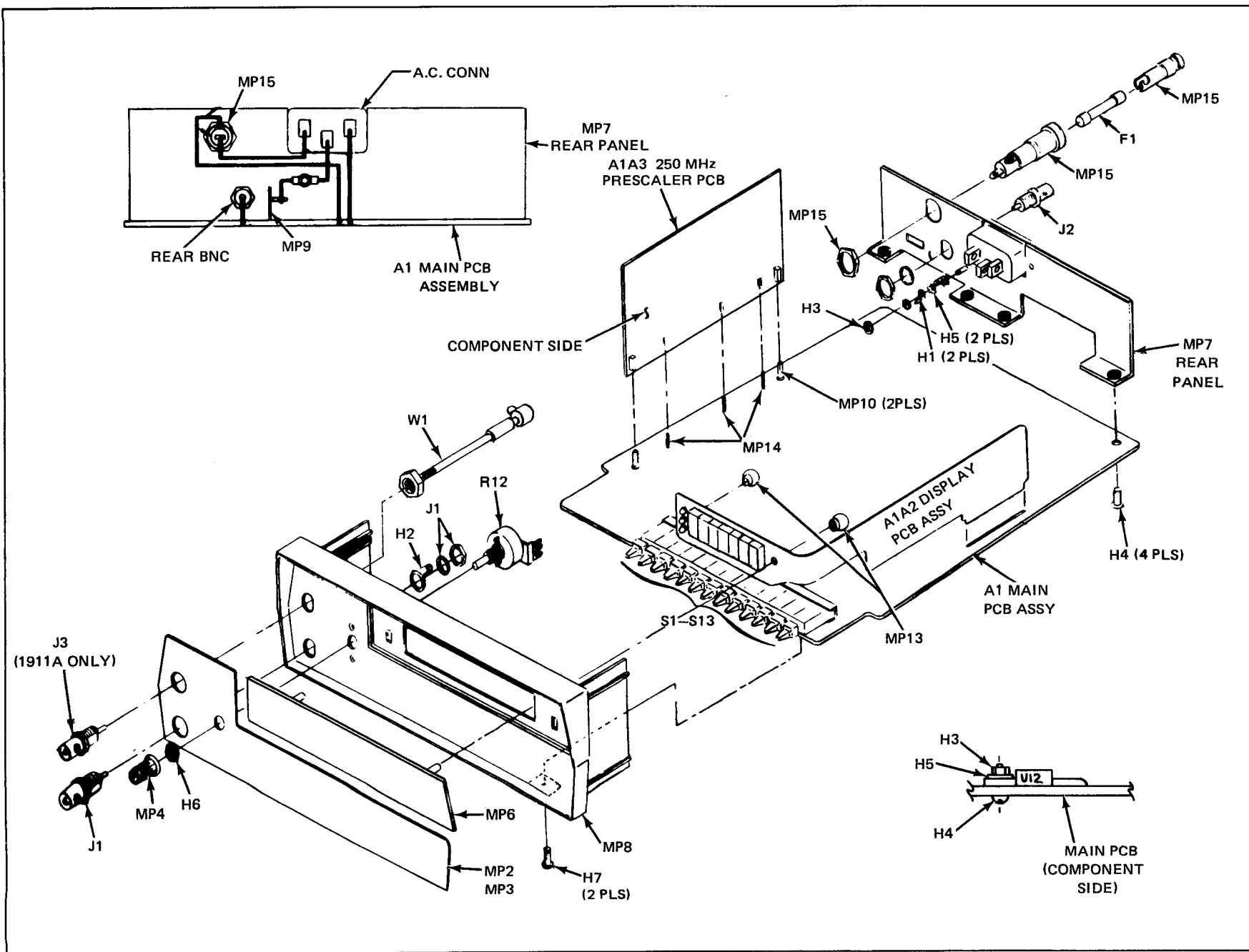


Table 5-3. A1A2 Display PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1A2	DISPLAY PCB ASSY (1910A-4020T) FIG 5-3	ORDER	MODEL	1910A OR 1911A	1		
CR201	DIODE, HI-SPEED SWITCHING	203323	07910	2N4448	4		
CR202	DIODE, HI-SPEED SWITCHING	203323	07910	2N4448	REF		
CR203	DIODE, HI-SPEED SWITCHING	203323	07910	2N4448	REF		
CR204	DIODE, HI-SPEED SWITCHING	203323	07910	2N4448	REF		
DS201	DIODE, LED, CLEAR	385898	28480	55082-4887	3		
DS202	DIODE, LED, CLEAR	385898	28480	55082-4887	REF		
DS203	DIODE, LED, CLEAR	385898	28480	55082-4887	REF		
U201	IC, DISPLAY LED	454249	28480	5082-7613	7	2	
U202	IC, DISPLAY LED	454249	28480	5082-7613	REF		
U203	IC, DISPLAY LED	454249	28480	5082-7613	REF		
U204	IC, DISPLAY LED	454249	28480	5082-7613	REF		
U205	IC, DISPLAY LED	454249	28480	5082-7613	REF		
U206	IC, DISPLAY LED	454249	28480	5082-7613	REF		
U207	IC, DISPLAY LED	454249	28480	5082-7613	REF		
U208	IC, MOS, DIGITAL	429506	12040	DS75492N	1	1	
U209	IC, C-MOS, DIGITAL HEX/BUFFER, INVERTER	381830	02735	CD4050AE	1	1	
U210	IC, RESISTOR NETWORK, 39 OHM, +/-5%	412866	89536	412866	1	1	
U211	IC, C-MOS, DIGITAL	429522	04713	MC14511CP	1	1	

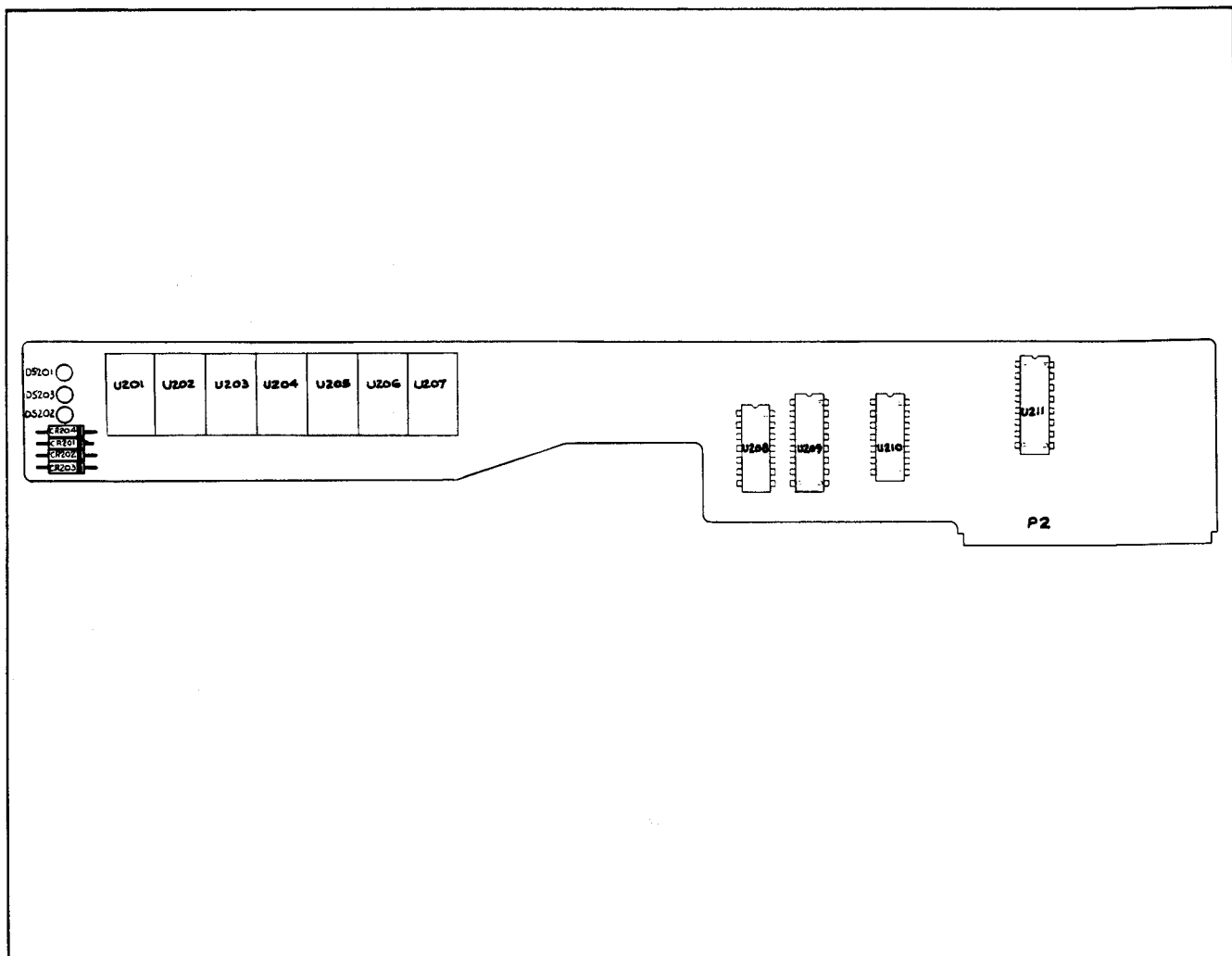


Figure 5-3. A1A2 Display PCB Assembly

Table 5-4. A1A3 250 MHz Prescaler PCB Assembly (1911A only)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1A3	250MHZ PRECALER ASSY(1911A-4003)FIG.5-4	443341	89536	443341	1		
C301	CAP,CER,0.01UF +/-20%,100V	407361	72982	821-A100-W5R-103M	10		
C302	CAP,CER,0.01UF +/-20%,100V	407361	72982	821-A100-W5R-103M	REF		
C303	CAP,CER,0.01UF +/-20%,100V	407361	72982	821-A100-W5R-103M	REF		
C304	CAP,CER,0.01UF +/-20%,100V	407361	72982	821-A100-W5R-103M	REF		
C305	CAP,CER,0.01UF -20/+80%,25V	335786	72982	5835-000-Y5U-103Z	REF		
C306	CAP,CER,0.01UF +/-20%,100V	407361	72982	821-A100-W5R-103M	REF		
C307	CAP,CER,MINI,5.0PF +/-0.5PF,500V	148577	72136	DN15C050D	1		
C308	CAP,CER,0.01UF +/-20%,100V	407361	72982	8121-A100-W5R-103M	REF		
C309	CAP,CER,0.01UF +/-20%,100V	407361	72982	821-A100-W5R-103M	REF		
C310	CAP,CER,0.01UF +/-20%,100V	407361	72982	821-A100-W5R-103M	REF		
C311	CAP,CER,0.01UF +/-20%,100V	407361	72982	821-A100-W5R-103M	REF		
C312	CAP,CER,0.01UF +/-20%,100V	407361	72982	821-A100-W5R-103M	REF		
C313	CAP,CER,0.01UF -20/+80%,25V	335786	72982	5835-000-Y5U-103Z	3		
C314	CAP,CER,0.01UF -20/+80%,25V	335786	72982	5835-000-Y5U-103Z	REF		
CR301	DIODE,HOT CARRIER	369595	07263	FH100	5	1	
CR302	DIODE,HOT CARRIER	369595	07263	FH100	REF		
CR303	DIODE,HOT CARRIER	369595	07263	FH100	REF		
CR304	DIODE,HOT CARRIER	369595	07263	FH100	REF		
CR305	DIODE,HOT CARRIER	369595	07263	FH100	REF		
F301	FUSE,0.2 AMP	370577	75915	273.200	2	10	
J3	CONN,JACK,BLACK	149112	74790	105-0753	2		
J4	CONN,RECEPTACLE, SMALL	375329	00779	85863-3	3		
Q301	XSTR,SI,NPN	453688	01295	A5T3571	2	1	
Q302	XSTR,SI,NPN	453688	01295	A5T3571	REF		
R301	RES,COMP,82 +/-5%,1/4W	108746	01121	EEB8205	1		
R302	RES,COMP, 39 +/-5%,1/2W	160036	01121	EB3905	1		
R303	RES,DEP CAR,100 +/-5%,1/4W	348771	80031	CR251-4-5P100ET	1		
R304	RES,DEP CAR,2.2K +/-5%,1/4W	343400	80031	CR251-4-5P2K2T	1		
R305	RES,DEP CAR,10K +/-5%,1/4W	348839	80031	CR251-4-5P10KT	6		
R306	RES,DEP CAR,15+/-5%,1/4W	348755	80031	CR251-4-5P15ET	1		
R307	RES,DEP CAR,150 +/-5%,1/4W	343442	80031	CR251-4-5P150ET	1		
R309	RES,DEP CAR,270 +/-5%,1/4W	348789	80031	CR251-4-5P270ET	1		
R310	RES,VAR,CAR,10K +/-20%	385393	54869	PT10H(2.5)-10K	1	1	
R311	RES,DEP CAR,220 +/-5%,1/4W	342626	80031	CR251-4-5P220ET	1		
R312	RES,DEP CAR,560 +/-5%,1/4W	385948	80031	CR251-4-5P560ET	1		
R313	RES,DEP CAR,1K +/-5%,1/4W	343426	80031	CR251-4-5P-1KT	3		
R314	RES,DEP CAR,10K +/-5%,1/4W	348839	80031	CR251-4-5P10KT	REF		
R315	RES,DEP CAR,330K +/-5%,1/4W	376640	80031	CR251-4-5P330KT	1		
R316	RES,DEP CAR,1K +/-5%,1/4W	343426	80031	CR251-4-5P-1KT	REF		
R317	RES,DEP CAR,10K +/-5%,1/4W	348839	80031	CR251-4-5P10KT	REF		
R318	RES,DEP CAR,10K +/-5%,1/4W	348839	80031	CR251-4-5P10KT	REF		
R320	RES,DEP CAR,1K +/-5%,1/4W	343426	80031	CR251-4-5P-1KT	REF		
R321	RES,DEP CAR,56K +/-5%,1/4W	441626	80031	CR251-4-5P56KT	1		
R322	RES,DEP CAR,10K +/-5%,1/4W	348839	80031	CR251-4-5P10KT	REF		
R323	RES,DEP CAR,270 +/-5%,1/4W	348789	80031	CR251-4-5P270ET	REF		
U301	IC,DGTL,ECL,330MHZ,DIVIDE BY 2 COUNTER	429613	52648	SP8604B	1	1	
U302	IC,DGTL,ECL,TRIPLE LINE RECEIVER	369702	18324	N10116B	1	1	
U303	IC,LIN,OP AMP	402750	12040	LM741CN	1	1	
XF301	SOCKET,SPRING TYPE,FUSE	403642	00779	50863-8	4		

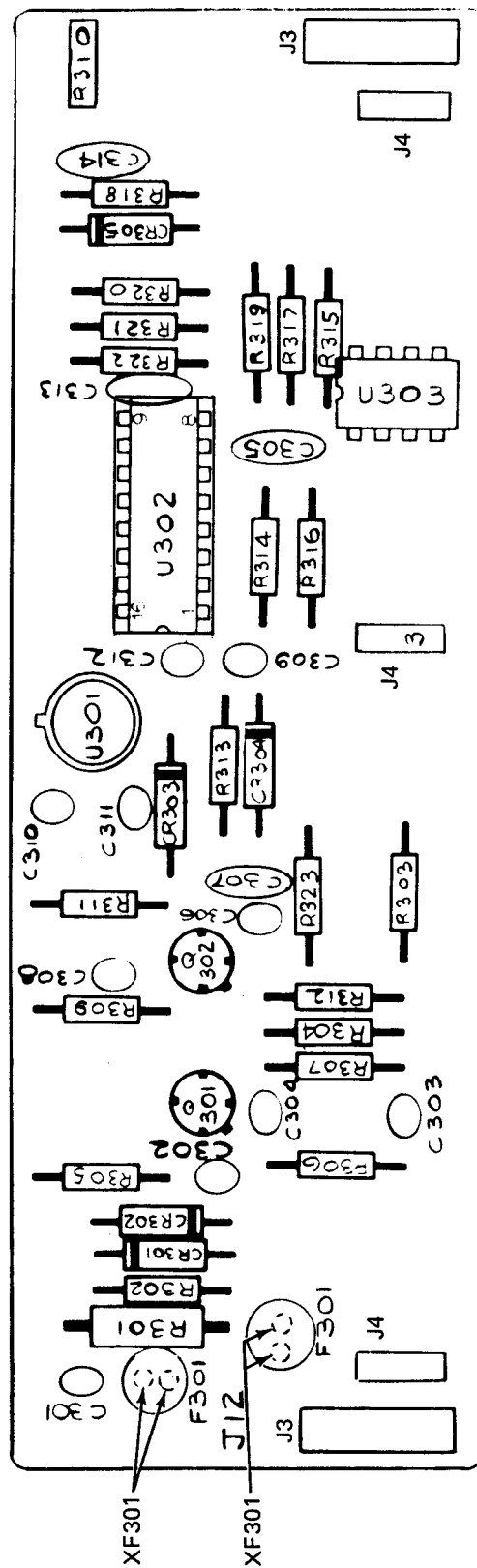


Figure 5-4. A1A3 250 MHz Prescaler PCB Assembly (1911A only)



## Section 6

# Option & Accessory Information

### 6-1. INTRODUCTION

6-2. This section of the manual contains information pertaining to the accessories and options available for your instrument.

### 6-3. ACCESSORY INFORMATION

6-4. The accessory information, if applicable, will contain details concerning accessories that may be used with this particular instrument.

### 6-5. OPTION INFORMATION

6-6. Each of the options available for this instrument if any, are described separately under headings containing the option number. The option descriptions contain applicable operating and maintenance instructions and field installation procedures. A complete list of replaceable parts for each option is contained at the end of that option description.

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OPTION/ MODEL NO.	DESCRIPTION	PAGE NO.
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	OPTIONS	
-01	Battery Operation . . . . .	601-1
-02	Data Output Unit . . . . .	602-1
-03	Temperature Compensated Oscillator (TCXO) . . . . .	603-1
-04	Superior Temperature Compensated Oscillator (TCXO) . . . . .	603-1

## Accessories

### 600-1. INTRODUCTION

600-2. Accessories for the Model 1910A and 1911A are described in the following paragraphs. Refer to Section 1, Table 1-2, for the list of all accessories.

### 600-3. CARRYING CASE (C80)

600-4. The Model C80 Carrying Case, Figure 600-1, is a soft vinyl plastic container designed for the storage and transport of the 1910A, or 1911A. The case provides the multi-counters with adequate protection against normal handling and storage conditions. A separate storage compartment is provided for test leads, power cord, and other compact accessories.

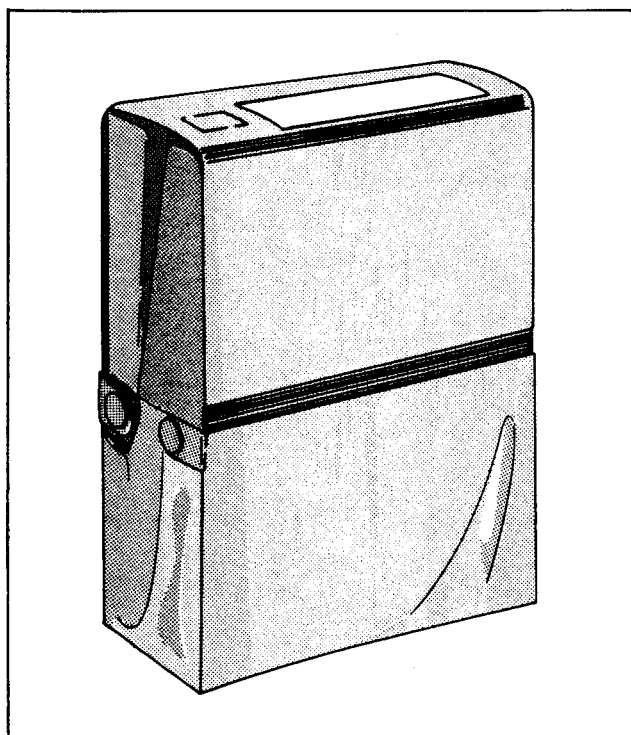


Figure 600-1. Model C80 Carrying Case

### 600-5. CARRYING CASE (C86)

600-6. The Model C86 Carrying Case, Figure 600-2, is a molded polyethylene container with handle designed for use in transporting the 1910A, or 1911A. This rugged case provides the counters with maximum protection against rough handling and adverse weather conditions. A separate storage compartment is provided for test leads, power cord, and other compact accessories.

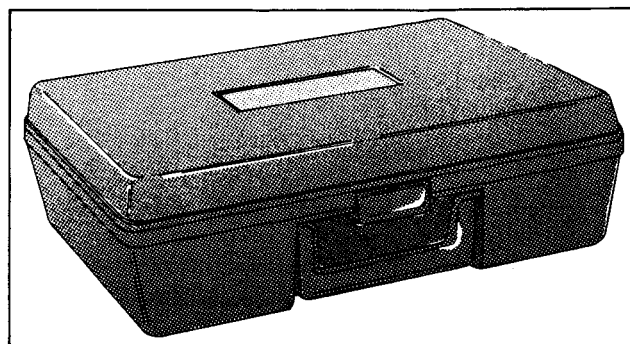


Figure 600-2. Model C86 Carrying Case

### 600-7. FRONT PANEL DUST COVER (MOO-100-714)

600-8. The front panel dust cover is a molded plastic snap-on accessory which fits over the front panel of the 1910A/1911A. The dust cover provides protection for the front panel controls, and is useful when storing or transporting the 1910A or 1911A.

### 600-9. RACK MOUNTING KITS

#### 600-10. Introduction

600-11. Three rack mounting kits are available for mounting the 1910A or 1911A in a standard 19-inch equipment rack. The kits, listed in Table 600-1, provide the option of either offset mounting (left/right), center mounting or side-by-side mounting.

**Table 600-1. Rack Mounting Kits**

MOUNTING STYLE	MODEL NUMBER
Offset	MOO-200-611
Center	MOO-200-612
Side-By-Side	MOO-200-613

**600-12. Installation Procedure**

600-13. Installation instructions for each of the rack mounting kits is given in the following paragraphs. Use the procedure which corresponds to the model number of the kit being installed.

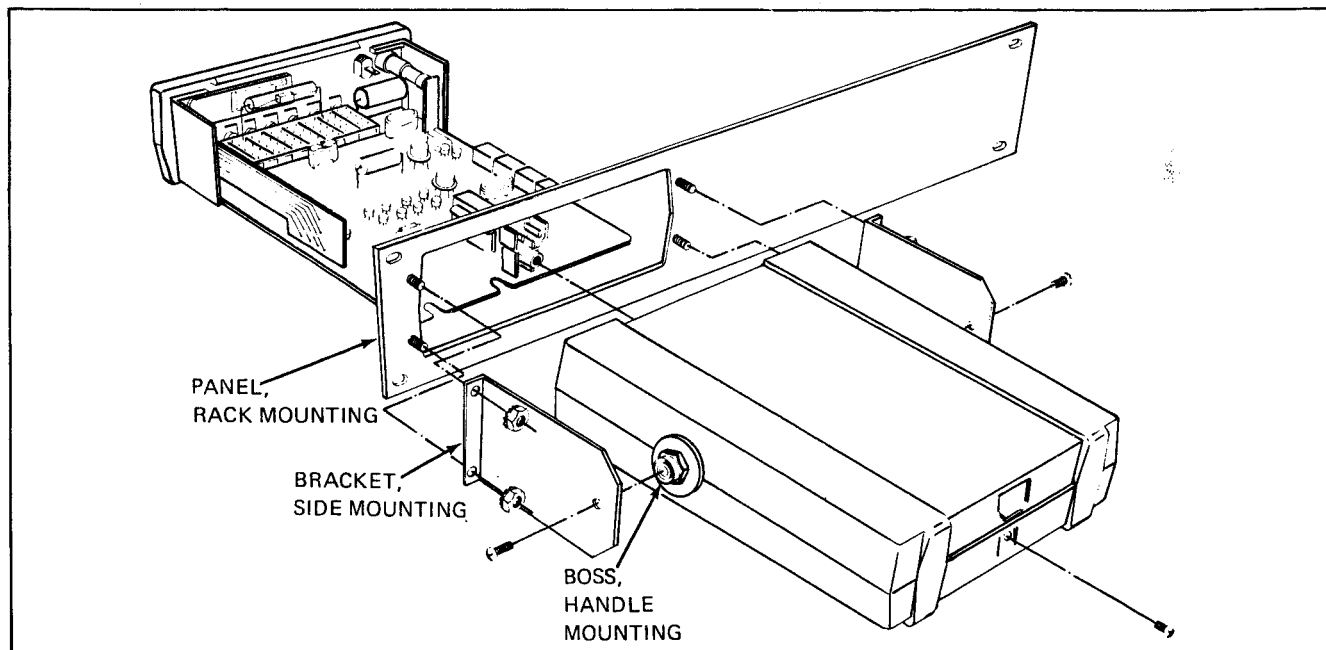
**600-14. OFFSET AND CENTER MOUNTING KITS (MOO-200-611 and MOO-200-612)**

1. Remove the multi-counters carrying handle by removing the handle disc decals and the handle mounting screws.
2. Remove screw from rear of case and separate the case from the 1910A or 1911A unit.
3. Install the side mounting brackets, as shown in Figure 600-3, and secure them to the mounting panel using the nuts provided.
4. Insert the front of the multi-counters case through the opening on the back side of the mounting panel.
5. Install the handle mounting screws through the side brackets into the handle mounting bosses. Don't over tighten these screws.

6. Slide the 1910A's or 1911A's unit through the mounting panel and into the case. Install and tighten the retaining screw at the rear of the case.

**600-15. SIDE-BY-SIDE MOUNTING KIT (MOO-200-613)**

1. Remove the carrying handles from both multi-counters by removing the handle disc decals and the handle mounting screws (Figure 600-5).
2. Remove the retaining screw from the rear of the cases and separate the instruments from their cases.
3. Install the center mounting bracket, as shown in Figure 600-5, and secure it to the mounting panel using the nuts provided.
4. Install the clamp screw in the center mounting bracket using the nuts and washers provided.
5. Insert the front of the instrument cases through the openings on the back side of the mounting panel. Make sure the case's handle mounting bosses are inserted into the clamp hole of the center mounting bracket.
6. Tighten the clamp screw.
7. Install the side mounting brackets and secure them to the front panel using the nuts provided.
8. Install the handle mounting screws through the side brackets into the handle mounting bosses. Don't over tighten these screws.
9. Slide the multi-counters through the mounting panel and into their cases. Install and tighten the retaining screw at the rear of both cases.

**Figure 600-3. Rack Mounting Kit, Offset Mounting**

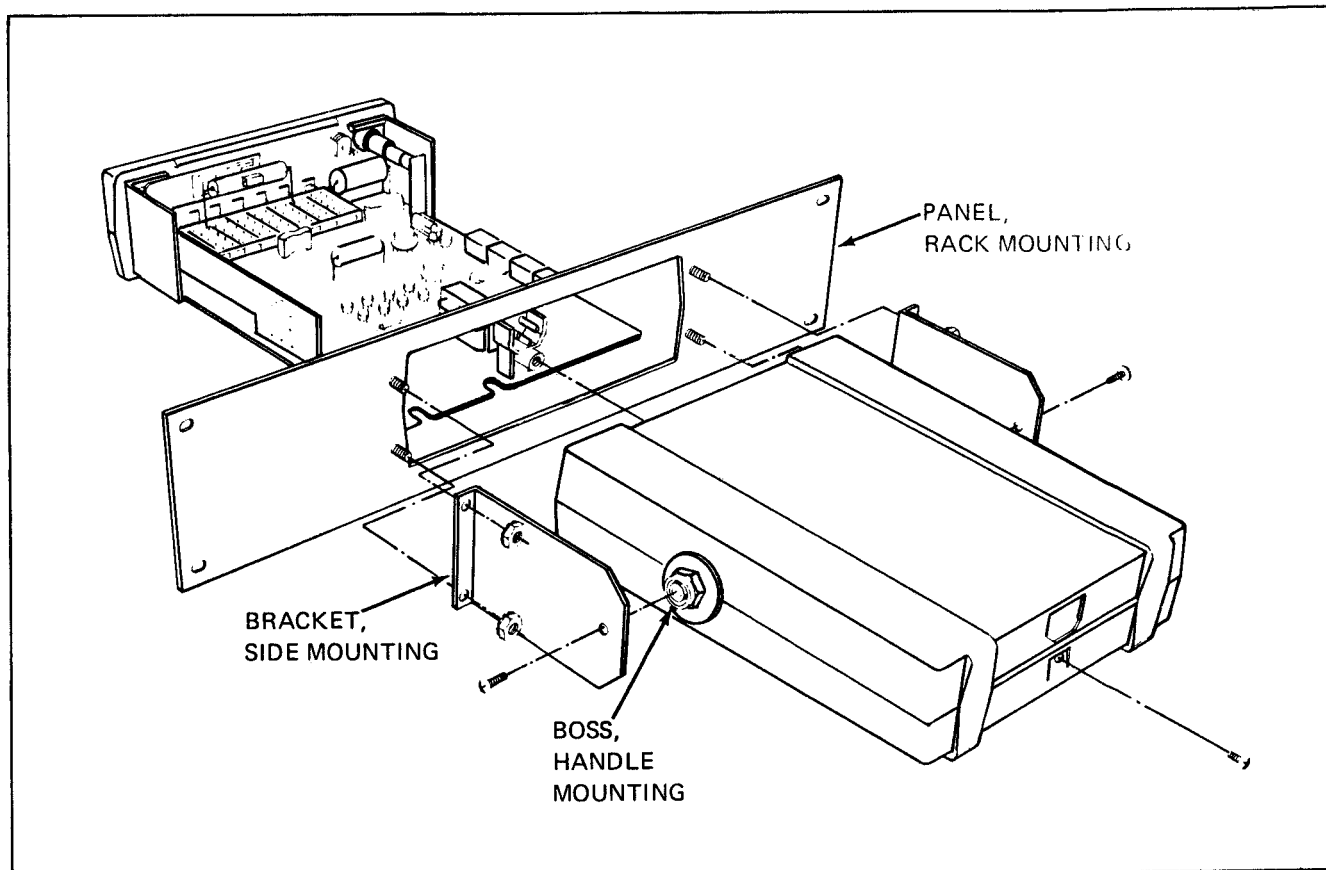


Figure 600-4. Rack Mounting Kit, Center Mounting

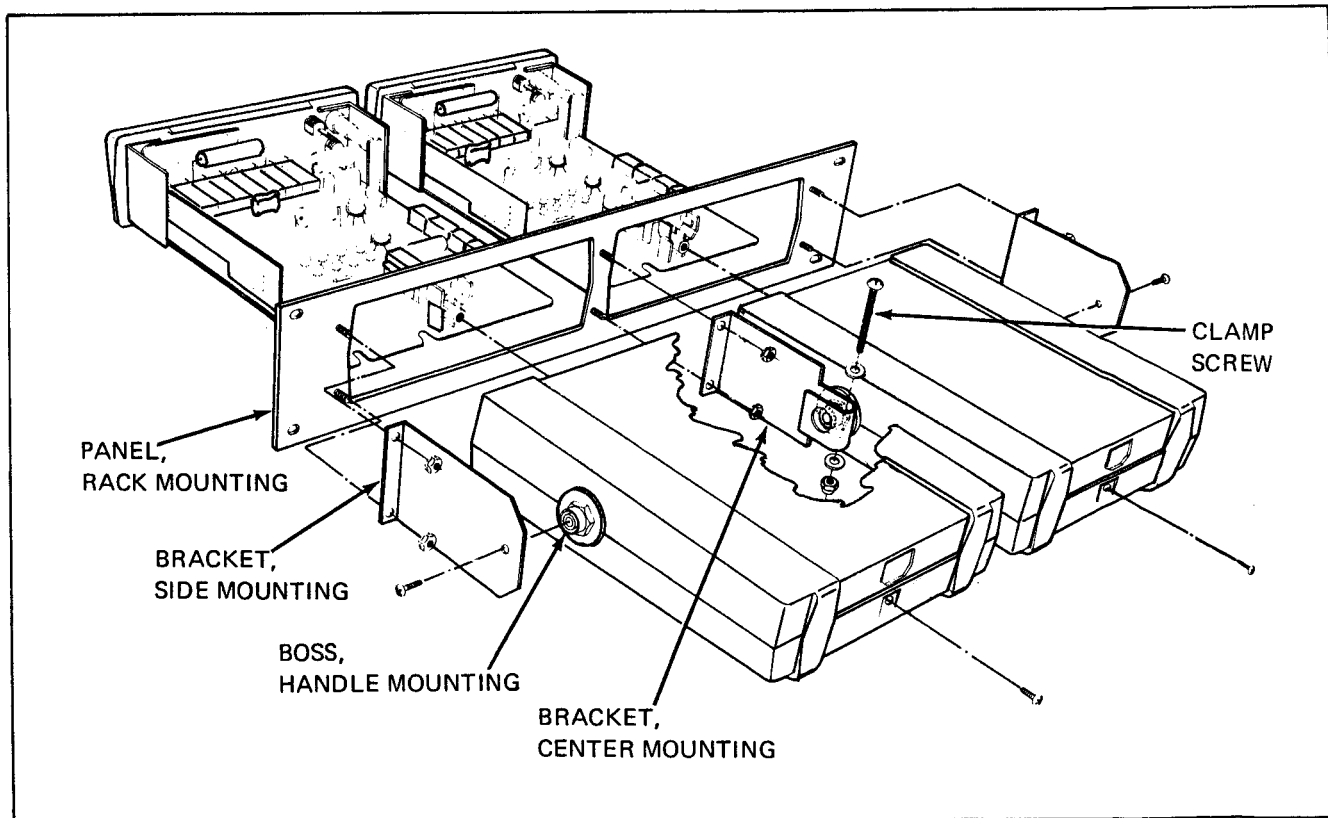


Figure 600-5. Rack Mounting Kit, Side-by-Side Mounting

## Option -01 Battery Pack

### WARNING

**WHEN THE COUNTER IS OPERATING FROM THE BATTERY PACK THE UNIT WILL HAVE NO GROUND REFERENCE AND INPUT TO THE COUNTER MUST BE LIMITED TO A MAX OF 30V.**

### 601-1. INTRODUCTION

#### CAUTION

**Any attempt to charge alkaline, zinc-carbon, or mercury batteries may damage the instrument.**

601-2. Power for the instrument with the -01 option installed is supplied by internal rechargeable batteries that allow the instrument to operate for at least four hours. The batteries should be recharged after every four hours of operation or when the input sensitivity falls below specifications. Recharging is most rapidly accomplished by connecting the counter to the line and depressing the POWER Switch to the STBY position.

601-3. In this way, the discharged batteries can be completely recharged in approximately 16 hours. The instrument can also be operated when recharging, however the recharging time will be significantly extended.

#### NOTE

*Battery manufacturers recommend that nickel-cadmium batteries not be stored for extended periods of time without recharging at least every 90 days. Storage temperature below 25°C is recommended.*

### 601-4. INPUT POWER (-01 OPTION)

601-5. To enable the unit to be compatible with international line voltages and frequencies it has been designed to operate from the following configurations: 100V 48-52 Hz, 100V 58-62 Hz, 115V 58-62 Hz, and 230 V 48-52 Hz. Therefore for battery charging purposes the AC PCB 601-4, unique for that particular line voltage and frequency must be used, (See AC PCB parts list and schematic). These modifications shall be initiated by ordering the battery option and specifying the line voltages and frequencies from which the unit shall be operated.

### 601-6. AC PCB

601-7. The AC PCB modifies the Main PCB -01, such that the unit is capable of charging the batteries from various input voltages and frequencies. Basically the circuit is a constant current source determined by the value of the input capacitor C601.

### 601-8. Inverter PCB

601-9. The Inverter PCB is a dc to dc converter used to change the +5V battery output to -12V (a level compatible with all input power configurations).

### 601-10. BATTERY AND FUSE REPLACEMENT

#### CAUTION

**Disconnect the instrument from the input line power before removing batteries.**

601-11. The procedure described below provides step-by-step instructions for replacing the batteries.

1. Disconnect line power cord. Remove retainer screw from rear of instrument case, and remove instrument from case.

1910A/1911A

2. On the underside of PCB, remove two threaded bolts securing battery holders in place.
3. Remove holder tops and batteries.
4. Replace batteries with 1.2 volt nickel-cadmium batteries (JF Part No. 346924). Install the batteries adhering to polarity indications on Main PCB.

*NOTE*

*Use 1.2 volt nickel-cadmium batteries only.*

601-12. The procedure described below provides step-by-step instructions for replacing the battery fuse.

1. Disconnect line power cord. Remove retainer screw from rear of instrument case, and remove instrument from its case.
2. Remove bottom shield.
3. The fuse is located directly on the underside of the main pcb. It is clearly marked (Fuse), and may be checked visually.
4. Replace fuse if necessary by ordering: Part No. 167312.

Table 601-1. 1910A/1911A Final Assembly, Battery Power

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	1910A/1911A FINAL ASSEMBLY	ORDER	MODEL	1910A-01 OR 1911A-01			
	FIGURE 601-1						
A1	MAIN PCB ASSY (10A/11A-4011)	ORDER	MODEL	1910A-01 OR 1911A-01	1		
A2	INVERTER PCB ASSEMBLY (10A/11A-4004T)	443333	89536	443333	1		
A3	AC PCB ASSEMBLY	ORDER	FOR	APPLICABLE SOURCE			
H1	SCREW, PHP, 2-56 X 1/4	149534	89536	149534			
H2	SCREW, PHP, 6-32 X 3/8	288266	89536	288266	2		
H3	WASHER, FLAT	340505	89536	340505	2		
H4	WASHER, LOCK. INT TOOTH #2	110676	89536	110676	2		
H5	SCREW, 6-32 X 3/8	152165	89536	152165	1		
MP1	BASIC CASE	458331	89536	458331	1		
MP2	FOOT PAD	338632	89536	338632	2		
MP3	HANDLE, MOLDED	330092	89536	330092	1		
MP5	SHEILD, BOTTOM	458869	89536	4588369	1		
MP6	SHEILD, TOP	459248	89536	4459248	1		
MP7	SPECIFICATION DECAL	429316	89536	429316	1		
MP8	KNOB DECAL	347401	89536	347401	2		
U6	IC, P-MOS (INSTALLED IN TEST)	SEE	SECT.	5			
U7	IC, MOS (INSTALLED IN TEST)	SEE	SECT.	5			
W1	LINE CORD W/INTERNAL CONN.(NOT SHOWN)	343723	89536	343723	1		

Figure 601-1. 1910A/1911A Final Assembly, Battery Power

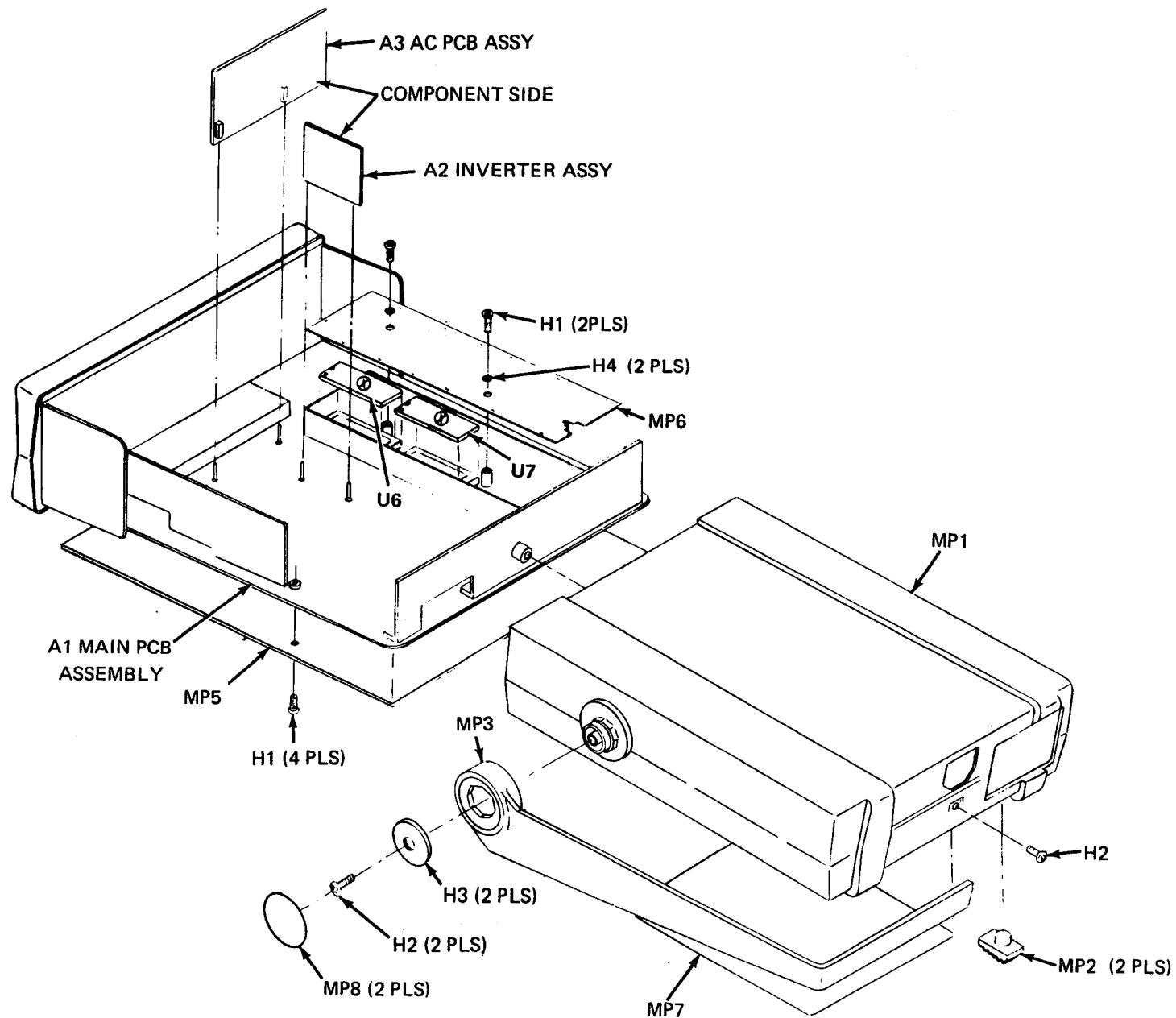




Table 601-2. A1 Main PCB Assembly, Battery Option

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CODE
A1	①MAIN PCB ASSY,(10A/11A-4011)FIG 601-2	ORDER	MODEL	1910A-01 OR 1911A-01	1		
A1A2	DISPLAY PCB ASSY (1910A-4020T)		SEE	SECTION 5	1		
A1A3	250 MHZ PRESCALER PCB ASSY (1911A-4003T)		SEE	SECTION 5	1		
BT1	BATTERY,NI-CAD	346924	06001	41B004AD15	4	4	
BT2	BATTERY,NI-CAD	346924	06001	41B004AD15	REF		
BT3	BATTERY,NI-CAD	346924	06001	41B004AD15	REF		
BT4	BATTERY,NI-CAD	346924	06001	41B004AD15	REF		
C1	CAP,ELECT,10,000UF,-10/+100%,6V	387241	25088	B41010/100006	1	1	
C4	CAP,CER,0.01UF,+/-20%,100V	149153	56289	C023B101F-103M	6		
C5	CAP,VAR,7PF-25PF,350V	229948	72982	538-006B-07-25	1	1	
C6	CAP,CER,22PF,+/-20%,10KV	369157	72982	831-000-00G0-220	4		
C7	CAP,CER,47PF,+/-20%,1000V	369132	56289	C0C030B102H-470J	1		
C8	CAP,CER,0.01UF,+/-20%,100V	149153	56289	C023B101F-103M	REF		
C9	CAP,CER 0.001UF +/-10%,1KV	368621	71590	DD-102	1		
C10	CAP,POLY STR,FILM,1UF,+/-10%,400V	447537	73445	C280MAF/A100K	1		
C11	CAP,CER,100PF,+/-10%,1KV	105593	71590	DD101	1		
C12	CAP,CER,22PF,+/-20%,10KV	369157	72982	831-000-00G0-220	REF		
C13	CAP,TA,10UF,+/-20%,15V	193623	56289	196D106X-0015KA1	7		
C14	CAP,TA,22UF,+/-20%,15V	423012	56289	196D226X-0015KA1	2		
C15	CAP,CER,1000PF,+/-20%,100V	402966	72982	8121-A100-W5R-102M	5		
C16	CAP,TA,10UF,+/-20%,15V	193623	56289	196D106X-0015KA1	REF		
C17	CAP,TA,10UF,+/-20%,15V	193623	56289	196D106X-0015KA1	REF		
C18	CAP,CER,1000PF,+/-20%,100V	402966	72982	8121-A100-W5R-102N	REF		
C19	CAP,TA,10UF,+/-20%,15V	193623	56289	196D106X-0015KA1	REF		
C20	CAP,CER,1000PF,+/-20%,100V	402966	72982	8121-A100-W5R-102N	REF		
C21	CAP,CER,22PF,+/-20%,10KV	369157	72982	831-000-00G0-220	REF		
C22	CAP,CER,1000PF,+/-20%,100V	402966	72982	8121-A100-W5R-102N	REF		
C23	CAP,CER,0.01UF,+/-20%,100V	149153	56289	C023B101F-103M	REF		
C24	CAP,CER,0.01UF,+/-20%,100V	149153	56289	C023B101F-103M	REF		
C25	CAP,CER,0.01UF,+/-20%,100V	149153	56289	C023B101F-103M	REF		
C26	CAP,TA,1UF +/-20%,35V DCW	161919	56289	196D105X-0035JA1	1		
C27	CAP,CER,0.01UF +/-20%,100V	407361	72982	812-A100-W5R-103M	1		
C28	CAP,TA,10UF,+/-20%,15V	193623	56289	196D106X-0015KA1	REF		
C29	CAP,CER,0.0012UF,+/-10%,500V DCW	106732	71590	CF122	1		
C30	CAP,TA,22UF,+/-20%,15V	423012	56289	196D226X-0015KA1	REF		
C31	CAP,TA,10UF,+/-20%,15V	193632	56289	196D106X-0015KA1	REF		
C32	CAP,TA,10UF,+/-20%,15V	193623	56289	196D106X-0015KA1	REF		
C33	CAP,CER,1000PF,+/-20%,100V	402966	72982	8121-A100-W5R-102M	REF		
CR1	DIODE,SI,RECTIFIER	343491	04713	1N4002	2	1	
CR2	DIODE,SI,RECTIFIER	343491	04713	1N4002	REF		
CR6	DIODE,HI-SPEED SWITCHING	203323	07910	1N4448	3	1	
CR7	DIODE,HI-SPEED SWITCHING	203323	07910	1N4448	REF		
CR8	DIODE,LO-CAP	381806	07910	1N3062	2	1	
CR9	DIODE,LO-CAP	381806	07910	1N3062	REF		
CR11	DIODE,ZENER,400MW,+/-5%,6.8V	260695	07910	1N754A	1	1	
CR12	DIODE,HI-SPEED SWITCHING	203323	07910	1N4448	REF		
F1	FUSE,SLO-ACTNG,1/2 AMP	109322	71400	MDL1-2	1	5	
F2	WIRE #42 (USED AS A FUSE,NOT SHOWN)	167312	89536	167312	AR		
H1	LUG,SOLDER	151431	79963	329	2		
H2	LUG,SOLDER	441972	79963	761	1		
H3	NUT,HEX 1/4 - 32	110601	89536	110601	1		
H4	NUT,HEX,4-40	110635	89536	110635	2		
H5	NUT,HEX,6-32	110551	89536	110551	2		
H6	SCREW,PHP 4-40 X 1/4	129890	89536	129890	4		
H7	SCREW,6-32 X 1.56	347427	89536	347427	2		
H8	SCREW,S.T.,6-32 X 3/16	381087	89536	381087	2		
H9	WASHER,INT LOCK #4	110403	89536	110403	3		
J1	RECEPTACLE,BNC	152033	95712	30355-1	3		
J8	RECEPTACLE,BNC	152033	95712	30355-1	REF		
J12	RECEPTACLE,BNC (1911A ONLY)	152033	95712	303551	REF		
MP1	ABSORBANT DISC	458653	89536	458653	4		
MP2	ABSORBANT PAD	458661	89536	458661	2		

Table 601-2. A1 Main PCB Assembly, Battery Option (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
MP3	CABLE CLAMP (NOT SHOWN)	172080	06383	SST-1M	1		
MP4	DECAL FRONT PANEL (1910A-01 ONLY)	453977	89536	453977	1		
MP5	DECAL FRONT PANEL (1911A-01 ONLY)	453951	89536	453951	1		
MP6	DECAL,XFMR WARNING (NOT SHOWN)	386250	89536	386250	1		
MP7	CONTACT BATTERY	344200	89536	344200	8		
MP8	CABLE TIE	331157	06383	PLT2M	1		
MP9	RETAINER	352484	77969	9109-E	1		
MP10	TERMINAL PINS	376574	00779	3-87022-1	7		
MP11	HOLDER,BATTERY	390450	89536	390450	4		
MP12	KNOB,POINTER	448803	89536	448803	1		3
MP13	LENS,FRONT	456582	89536	456582	1		
MP14	PANEL,REAR	443291	89536	443291	1		
MP15	PANEL,FRONT	443283	89536	443283	1		
MP16	SHEILD,WALL	459230	89536	459230	1		
MP17	PIN,GUIDES	375840	89536	375840	6		
MP18(F1)	FUSE INSERT	460238	89536	460238	1		
Q1	XSTR,FET,JUNCTION,N-CHANNEL	288324	89536	288324	1	1	
Q2	XSTR,FET,JUNCTION,N-CHANNEL	404277	89536	404277	1	1	
Q3	XSTR,SI,PNP	195974	04713	2N3906	4	1	
Q4	XSTR,SI,PNP	195974	04713	2N3906	REF		
Q5	XSTR,SI,PNP	195974	04713	2N3906	REF		
Q6	XSTR,SI,PNP	195974	04713	2N3906	REF		
Q7	XSTR,SI,NPN	218396	04713	2N3904	5	1	
Q8	XSTR,FET,JUNCTION,N-CHANNEL	386094	89536	386094	1	1	
Q9	XSTR,SI,NPN	218396	04713	2N3904	REF		
Q10	XSTR,SI,NPN	218396	04713	2N3904	REF		
Q11	XSTR,SI,NPN	218396	04713	2N3904	REF		
Q12	XSTR,SI,NPN	218396	04713	2N3904	REF		
R1	RES,DEP CAR,1K +/-5% 1/4W	343426	80031	CR251-4-5P1KT	6		
R2	RES,DEP CAR,1M +/-5% 1/4W	348987	80031	CR251-4-5P1MT	4		
R3	RES,DEP CAR,2.7K +/-5% 1/4W	386490	80031	CR251-4-5P2K7T	3		
R4	RES,DEP CAR,180 +/-5% 1/4W	441436	80031	CR251-4-5P180ET	2		
R5	RES,DEP CAR,560 +/-5% 1/4W	385948	80031	C5251-4-5P560ET	5		
R6	RES,DEP CAR,10K +/-5% 1/4W	348839	80031	CR251-4-5P10KT	9		
R7	RES,DEP CAR,1M +/-5% 1/4W	348987	80031	CR251-4-5P1MT	REF		
R8	RES,DEP CAR,150 +/-5% 1/4W	343442	80031	CRCR251-4-5P150ET	2		
R9	RES,DEP CAR,1M +/-5% 1/4W	348987	80031	CR251-4-5P1MT	REF		
R10	RES,DEP CAR,2.7K +/-5% 1/4W	386490	80031	CR251-4-5P2K7T	REF		
R11	RES,VAR,CAR,COMP,10K +/-20% 0.2W	369553	54869	PT10V-10K	1	1	
R12	RES,SWITCH/POTENTIOMETER,10K	443044	89536	443044	1		
R13	RES,DEP CAR,22K +/-5% 1/4W	348870	80031	CR251-4-5P22KT	2		
R14	RES,DEP CAR,150K +/-5% 1/4W	348938	80031	CR251-4-5P150KT	1		
R15	RES,DEP CAR,1.5K +/-5% 1/4W	343418	80031	CR251-4-5P1K5T	2		
R16	RES,DEP CAR,1.5K +/-5% 1/4W	343418	80031	CR251-4-5P1K5T	REF		
R17	RES,DEP CAR,22K +/-5% 1/4W	348870	80031	CR251-4-5P22KT	REF		
R19	RES,DEP CAR,560 +/-5% 1/4W	385948	80031	C5251-4-5P560ET	REF		
R20	RES,VAR,CERMET,10K +/-10% 1/2W	309674	89536	309674	1		
R21	RES,DEP CAR,10K +/-5% 1/4W	348839	80031	CR251-4-5P10KT	REF		
R22	RES,DEP CAR,100K +/-5% 1/4W	348920	80031	CR251-4-5P100KT	3		
R23	RES,DEP CAR,1K +/-5% 1/4W	343426	80031	CR251-4-5P1KT	REF		
R24	RES,DEP CAR,1.2K +/-5% 1/4W	441378	80031	251-4-5P1K2T	REF		
R25	RES,DEP CAR,270 +/-5% 1/4W	348789	80031	CR251-4-5P270ET	1		
R26	RES,DEP CAR,220 +/-5% 1/4W	342626	80031	CR251-4-5P220ET	1		
R27	RES,DEP CAR,33 +/-5% 1/4W	414524	80031	CR251-4-5P33ET	1		

Table 601-2. A1 Main PCB Assembly, Battery Option (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R28	RES,DEP CAR,560 +/-5%,1/4W	385948	80031	C5251-4-5P560ET	REF		
R29	RES,DEP CAR,1K +/-5% 1/4W	343426	80031	CR251-4-5P1KT	REF		
R30	RES,DEP CAR,2.7K +/-5%,1/4W	386490	80031	CR251-4-5P2K7T	REF		
R31	RES,DEP CAR,150 +/-5%,1/4W	343442	80031	CR251-4-5P150ET	REF		
R32	RES,DEP CAR,1K +/-5% 1/4W	343426	80031	CR251-4-5P1KT	REF		
R33	RES,DEP CAR,560 +/-5%,1/4W	385948	80031	C5251-4-5P560ET	REF		
R34	RES,DEP CAR,1K +/-5% 1/4W	343426	80031	CR251-4-5P1KT	REF		
R35	RES,DEP CAR,10K +/-5%,1/4W	348839	80031	CR251-4-5P10KT	REF		
R36	RES,DEP CAR,100K +/-5%,1/4W	348920	80031	CR251-4-5P100KT	REF		
R37	RES,DEP CAR,1M +/-5%,1/4W	348987	80031	CR251-4-5P1MT	REF		
R38	RES,DEP CAR,1K +/-5% 1/4W	343426	80031	CR251-4-5P1KT	REF		
R39	RES,DEP CAR,10K +/-5%,1/4W	348839	80031	CR251-4-5P10KT	REF		
R41	RES,DEP CAR,10K +/-5%,1/4W	348839	80031	CR251-4-5P10KT	REF		
R42	RES,DEP CAR,27 +/-5%,1/4W	348763	80031	CR251-4-5P27ET	2		
R43	RES,DEP CAR,27 +/-5%,1/4W	348763	80031	CR251-4-5P27ET	REF		
R44	RES,DEP CAR,4.7K +/-5%,1/4W	348821	80031	CR251-4-5P4K7T	REF		
R45	RES,DEP CAR,4.7K +/-5%,1/4W	348821	80031	CR351-4-5P4K7T	REF		
R46	RES,DEP CAR,560 +/-5%,1/4W	385948	80031	C5251-4-5P560ET	REF		
R48	RES,DEP CAR,180 +/-5%,1/4W	441436	80031	CR251-4-5P180ET	REF		
R49	RES,DEP CAR,10K +/-5%,1/4W	348839	80031	CR251-4-5P10KT	REF		
R50	RES,DEP CAR,10K +/-5%,1/4W	348839	80031	CR251-4-5P10KT	REF		
R51	RES,DEP CAR,100K +/-5%,1/4W	348920	80031	CR251-4-5P100KT	REF		
R52	RES,DEP CAR,10K +/-5%,1/4W	348839	80031	CR251-4-5P10KT	REF		
R54	RES,COMP,47 +/-5% 1/4W	147892	U121	CB4705	1		
S1	BUTTON,GREEN	445197	89536	445197	1		
S1 - S13	SWITCH ASSEMBLY	429589	89536	429589	1		
S2	BUTTON,GREEN	445205	89536	445205	1		
S4	BUTTON,DARK GREY	426759	89536	426759	6		
S5	BUTTON,DARK GREY	426759	89536	426759	REF		
S6	BUTTON,DARK GREY	426759	89536	426759	REF		
S7	BUTTON,DARK GREY	426759	89536	426759	REF		
S8	BUTTON,LIGHT GREY	425900	89536	425900	5		
S9	BUTTON,LIGHT GREY	425900	89536	425900	REF		
S10	BUTTON,LIGHT GREY	425900	89536	425900	REF		
S11	BUTTON,LIGHT GREY	425900	89536	425900	REF		
S12	BUTTON,LIGHT GREY	425900	89536	425900	REF		
S13	BUTTON,DARK GREY	426759	89536	426759	REF		
S14	SWITCH,SLIDE	354878	95146	MSS22504	1	1	
S15	SEE R12						
T1	XFMR,BATTERY OPTION	463802	89536	463802	1		
U1	IC,CKT,ANALOG BIPOLAR DC WIDEBAND PREAMP	429191	89536	429191	1	11	
U2	IC,DGTL,ECL,EDGE TRIGGERED JK FLIP-FLOP	402743	12040	F95029DC	1	1	
U3	IC,TTL,DUAL,JK TRIGGERED FLIP-FLOP	363440	01295	SN74S112N	2	1	
U4	IC,TTL,DUAL,JK TRIGGERED FLIP-FLOP	363440	01295	SN74S112N	REF		
U5	IC,DGTL,QUAD,2-INPUT,POS NOR GATE	288845	01295	SN7402N	1	1	
U6	⊗ SEE FINAL ASSEMBLY PARTS LIST						
U7	⊗ SEE FINAL ASSEMBLY PARTS LIST						
U8	IC,TTL,50MHZ DECADE COUNTER	320754	01295	SN74196N	1	1	
U9	IC,DGTL,TTL MSI,DECADE COUNTER	402545	01295	SN74LS90N	1	1	
U10	IC,DGTL,MOS TO LED HEX DIGIT DRIVER	429506	12040	DS75492N	1	1	
U15	IC,LINEAR TIMER	402610	12040	LM555CN	1	1	
W1	CABLE ASSEMBLY (1911A ONLY)	468983	89536	468983	1		
XF1	FUSE HOLDER ASSEMBLY	460329	89536	460329	1		
XU1	SOCKET,IC,18 PIN	413229	91506	318-AG39D	1		
XU2	SOCKET,IC,16 PIN	276535	91506	316-AG39D	1		
XU6	SOCKET,IC,40 PIN	386060	09922	D1LB40P-1	2		
XU7	SOCKET,IC,40 PIN	386060	09922	D1LB40P-1	REF		
Y1	CRYSTAL,10MHZ	385732	89536	385732	1		

**WARNING:** ⚡ INDICATES USAGE OF MOS DEVICE(S)  
WHICH MAY BE DAMAGED BY STATIC DISCHARGE. USE  
SPECIAL HANDLING PER S.O.P. 15.7.



**CAUTION**  
SUBJECT TO DAMAGE BY  
STATIC ELECTRICITY

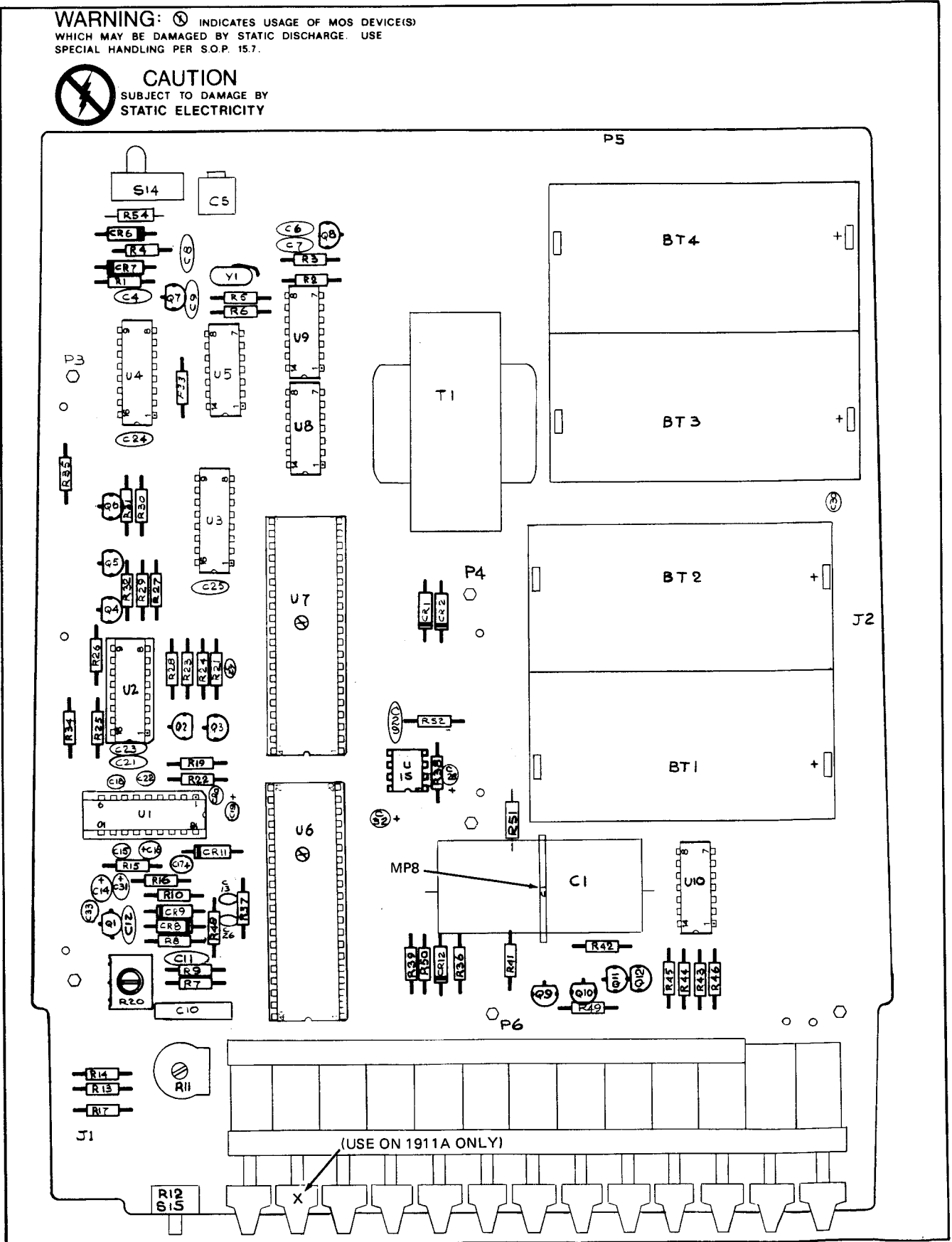
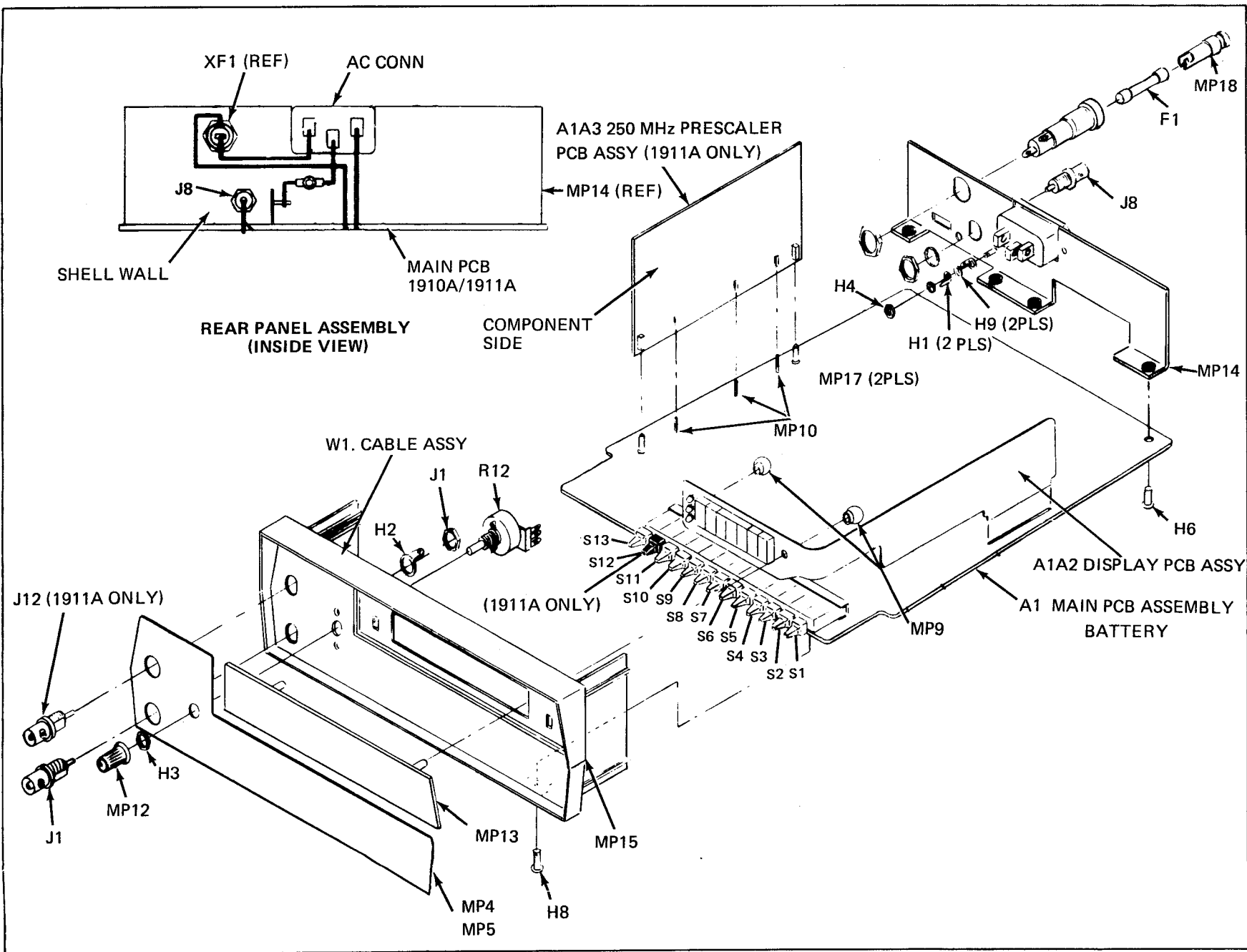
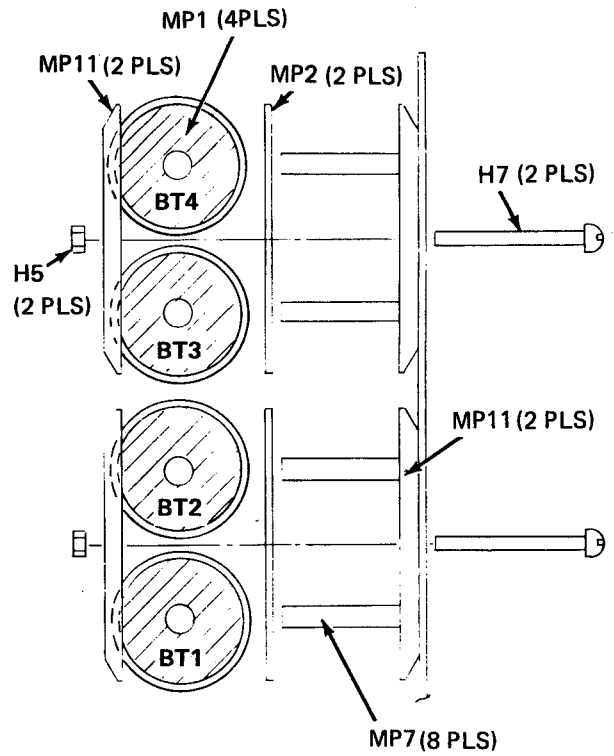


Figure 601-2. A1 Main PCB Assembly, Battery Option (Sht. 1 of 3)





- NOTES
1. ENSURE CORRECT ORIENTATION OF BATTERIES POSITIVE END AS INDICATED.
  2. BATTERIES TO BE MATCHED (PER DOT COLOR CODE)

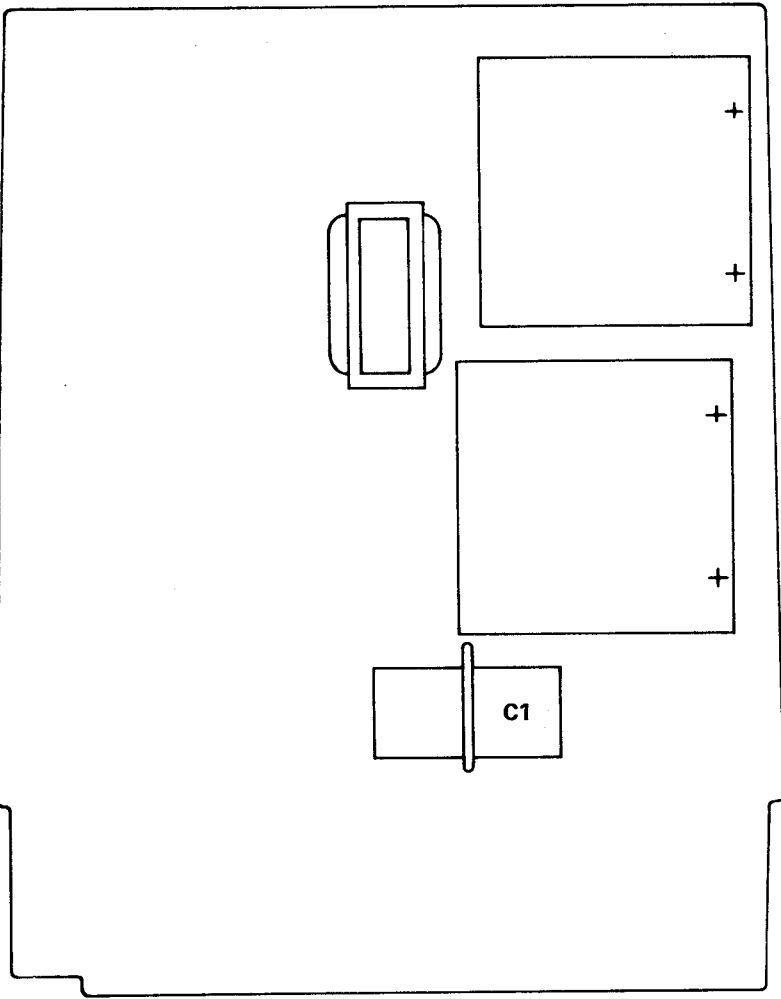


Figure 601-2. A1 Main PCB Assembly, Battery Option (Sheet 3 of 3)

Table 601-3. A2 Inverter PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A2	INVERTER PCB ASSEMBLY, FIGURE 601-3	443333	89536	443333	1		
C401	CAP, TA, 10UF, +/-20%, 15V	193623	56289	196D106X-0015KA1	3		
C402	CAP, TA, 10UF, +/-20%, 15V	193623	56289	196D106X-0015KA1	REF		
C403	CAP, CER, 0.1UF, +/-GMV, 20V MIN.	369199	71590	UK-10-1041	1		
C404	CAP, CER, 47PF, +/-20%, 1000V	369132	56289	C030B102-H470J	1		
C405	CAP, TA, 10UF, +/-20%, 15V	193623	56289	196D106X-0015KA1	REF		
L401	CHOKE, 6-TURN	320911	89536	320911	1		
Q401	XSTR, SI, NPN	218396	04713	2N3904	2	1	
Q402	XSTR, SI, NPN	218396	04713	2N3904	REF		
R401	RES, DEP CAR, 220, +/-5%, 1/4W	342626	80031	CR251-4-5P220ET	1		
R402	RES, DEP CAR, 82, +/-5%, 1/4W	442277	80031	CR251-4-5P82ET	1		
R403	RES, DEP CAR, 22, +/-5%, 1/4W	381145	80031	CR251-4-5P22ET	1		
T401	XFMR, INVERTER	462093	89536	462093	1		
U401	IC, LINEAR, NEG VOLT REG 3-TURN	429514	07263	79M12HC	1	1	
XU401	TRANSIPAD	152207	07047	10123DAP	1		

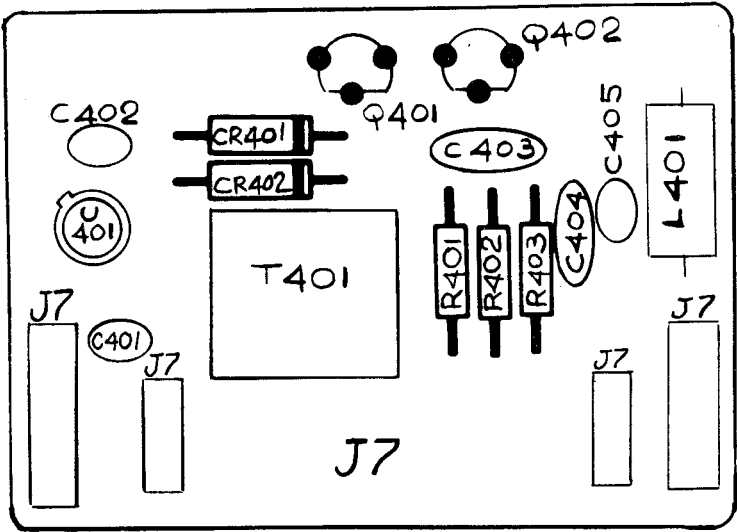


Figure 601-3. A2 Inverter PCB Assembly

Table 601-4. A3 AC PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A3	AC PCB ASSEMBLY,FIGURE 601-4	ORDER	FOR	REQUIRED SOURCE	1		
	AC PCB ASSY,115V SOURCE,58-62 HZ (10A/11A-4006T)	456251	89536	456251	1		
	AC PCB ASSY,230V SOURCE,48-52 HZ (10A/11A-4013T)	459362	89536	459362	1		
	AC PCB ASSY,100V SOURCE,48-52 HZ (10A/11A-4012T)	459370	89536	459370	1		
	AC PCB ASSY,100V SOURCE,58-62 HZ (10A/11A-4014T)	463307	89536	463307	1		
C601	CAPACITOR (SEE BELOW)	ORDER	FOR	REQUIRED SOURCE	1		
	CAP,MYLAR,6UF,+/-5%,200V DC,58-62 HZ USED ON 115V SOURCE	393546	06739	D2-505D	1		
	CAP,POLPRPLN,3.3UF,+/-5%,300V,48-52 HZ USED ON 230V SOURCE	380253	89536	394197	REF		
	CAP,MYLAR,6.0UF,+/-5%,115V,58-62 HZ	393546	89536	393546	1		
	CAP,MYLAR,6.6UF,+/-5%,300V,48-52 HZ USED ON 100V SOURCE	394189	89536	394189	1		
CR601	DIODE,ZENER,UNCOMP,40V	407825	12969	UZ8740	2		1
CR602	DIODE,ZENER,UNCOMP,40V	407825	12969	UZ8740	REF		
H1	CABLE TIE	331157	06383	PLT2M	1		
J7	CONN,RECEPTACLE	375329	00779	85863-3	2		
J8	PLUG/JACK PCB TEST	149112	74970	105-0753	2		
R601	RES,DEP CAR,1M,+/-5%,1/4W	348987	80031	CR251-4-RP1MT	1		

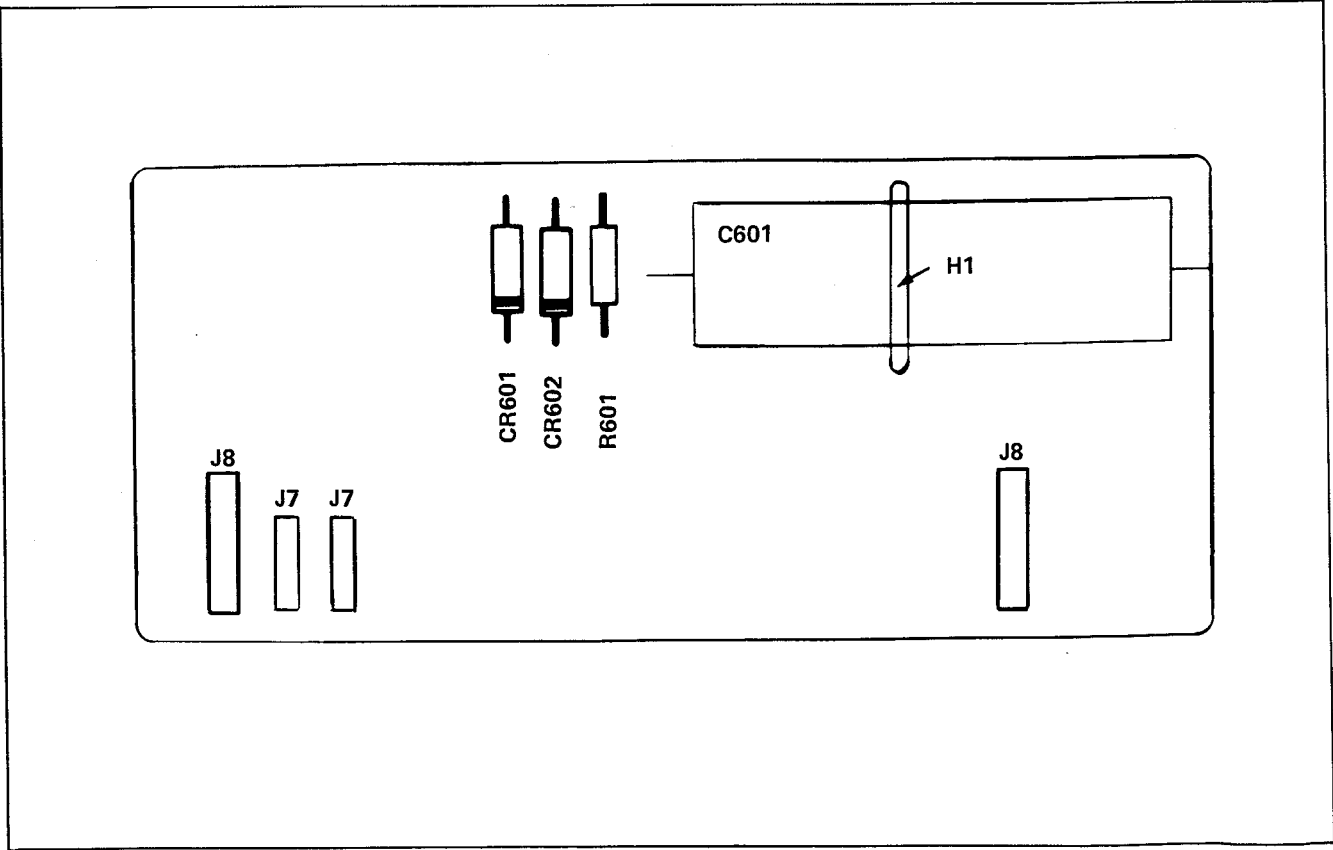


Figure 601-4. A3 AC PCB Assembly



## Option -02 Data Output Unit

### 602-1. INTRODUCTION

602-2. The DOU consists of 18 data lines containing all the display data necessary for external logging. The data lines are output on an extender PCB at the rear of the instrument. Due to space limitation the instrument may be ordered with either option -01 or -02, but not both.

### 602-3. OPERATION

602-4. The output data available at the rear panel DOU connector is listed in Table 602-1. The encoded input data to position the decimal in the frequency and period modes are given in Tables 602-2 and 602-3 respectively. To interface the DOU with an external logging unit see theory of operation of this section.

### 602-5. THEORY OF OPERATION

602-6. The DOU's output on connector J5 is obtained directly from the latches contained in U7. Its timing sequence is therefore exactly the same as the display strobe cycle (see Figure 602-1). Because the displays are strobed serially the output data on the DOU is also serial, and any external logging system interfaced with the DOU must be capable of using serial data or it must have its own serial to parallel converter.

602-7. The decimal point positioning and unit annunciators are enabled simultaneously with the selection of a range (see Table 602-2 for frequency mode encoding and Table 602-3 for period mode encoding).

Table 602-1. DOU Output Data

Pin No. (J5)	Nomenclature	Function
1 & 3 2 & 4	Not used	Ground
5	B1 (Blanking)	Blanks leading Zero
6	D, (8)	BCD Information
7	C, (4)	BCD Information
8	B, (2)	BCD Information
9	A, (1)	BCD Information
10	Dsl, (digit-1 strobe)	Enable 1st digit LED, (LSD, - strobed last)
11	DS2, (digit -2, strobe)	Enable 2nd LED, (2SD)
12	DS3, (digit-3 strobe)	Enable 3rd LED, (3SD)
13	DS4, (digit-4 strobe)	Enable 4th LED, (4SD)
14	DS5, (digit-5 strobe)	Enable 5th LED, (5SD)
15	DS6, (digit-6 strobe)	Enable 6th LED, (6SD)
16	Ovf1, (overflow)	Enable overflow annunciator, (goes high following MUP if carry out of MSD)
17	DP, (decimal position)	Occurs simultaneously with digit strobe.
18	UX, (Units enable)	Enable units annunciator simultaneously with digit strobe lines.
19	DS7 (digit 7 strobe)	Enable 7th LED, (MSD, strobed first)
20	M memory update	Indicates new data being entered.

Table 602-2 Decimal Positioning (Frequency Mode)

Encoded Input to U6 (Frequency Mode)			Gate Time	Decimal Location (Display LED)	Annunciator
22	23	24			
0	1	0	10 msec	D5	MHz
1	1	0	0.1 sec	D3	kHz
0	0	1	1.0 sec	D4	kHz
1	0	1	10 sec	D5	kHz
1	1	1	Autorange	*	*

\*In autorange the gate time varies between 0.1 and 1 sec.

Decimal and units corresponds to gate time as listed above.

Table 602-3 Decimal Positioning (Period Mode)

Encoded Input to U6 (Period Mode)			Cycles	Decimal Location (Display LED)	Annunciator
22	23	24			
0	0	0	■	D5	msec
1	0	0	■	D6	msec
0	1	0	■	D4	usec
1	1	0	■	D5	usec
1	1	1	Autorange	*	*

\*Autoranges through all four of the above ranges plus  $10^4$  periods averaged, which is D6 and usec's.

■ Not a fixed value.

#### NOTE

The drive capability of all data outputs in PMOS; able to sink 0.16 mA at logic 0 or source 0.16mA for logic 1 levels.

### 602-8. DOU Output Timing

602-9. The timing diagram of Figure 602-1 is for one test case in which an input signal of 3.8 MHz is applied to channel A, frequency mode, with 10 Hz resolution.

#### NOTE

The DOU data is output on connector J4 in bcd format serially, and is valid only on the positive edge of memory update (M).

### 602-10. DOU Interface Cable

602-11. A mating DOU connector is supplied as part of the -02 option for use in fabricating a custom interface cable. Use the following procedure to fabricate the interface cable:

- Assemble the following equipment:
  - Teflon or vinyl insulated wire, 26 gauge, 20 pieces cut to desired length.
  - Sleeving, # 16 for vinyl insulated wire, or # 18 for teflon insulated wire.
  - Rosin core solder, 60/40
  - Wire strippers
  - Soldering Iron, pencil-type (45W max.)
  - DOU mating connector
  - Mating connector for interfaced instrument
  - Connector vice
- Slide cable wires through the DOU connector backshell (hood) as shown in Figure 602-2.
- Strip one-eighth of an inch of insulation from the DOU connector end of the cable. Tin the ends.
- Cut 20 pieces of sleeving to a length of three-sixteenths of an inch.
- Slide one piece of sleeving over each prepared wire end.

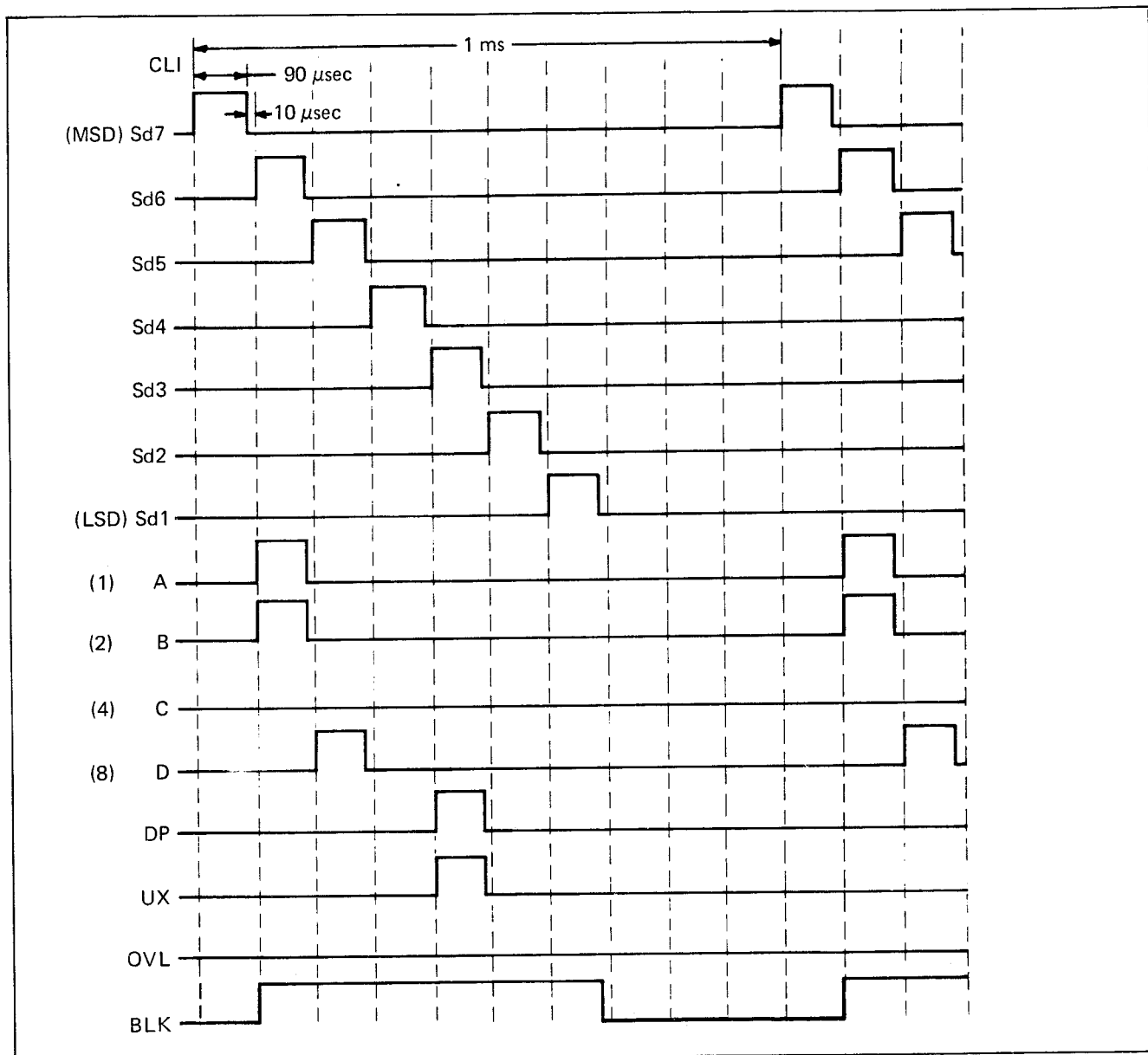


Figure 602-1. DOU Timing Diagram

6. Place the DOU mating connector in the connector vice, and tin each connector pin.
7. Solder one prepared wire to each connector pin.
8. Position the sleeving over the solder joints, and install the connector backshell (hood) and strain relief as shown in Figure 602-2.
9. Install the wires on the mating connector for the interfaced instrument using the DOU connector information given in Table 602-1.

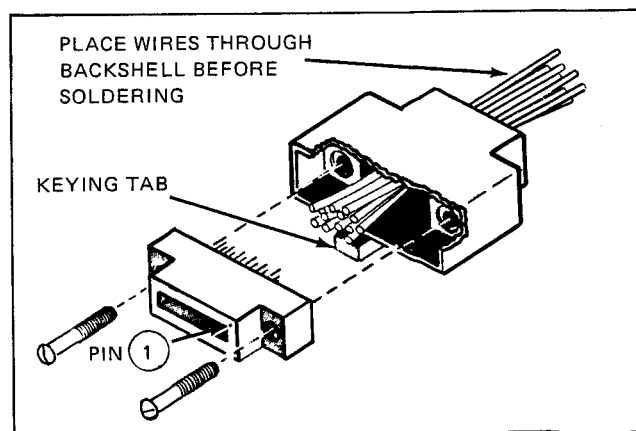


Figure 602-2. DOU Connector

Table 602-4. DOU PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CODE
	DOU ASSY.FIGURE 602-3 (SHEET 1 OF 2)	ORDER	1910A	-02 OR 1911A-02	1		
	DOU PCB ASSEMBLY (10A/11A-4005)	ORDER	NEXT	HIGHER LEVEL	1		
H1	SCREW,PHP,4-40 X 1/4	129890	73734	19022	2		
H2	SCREW,PHP,6-32 X 1/4 (NOT SHOWN)	152140	73734	19042	2		
J5	CONNECTOR,RECEPTACLE,CARD-EDGE	352310	89536	353210	1		
MP1	CABLE TIE,4 INCH (NOT SHOWN)	172080	06383	SST-1M	1		
MP2	CASE,DOU	458323	89536	458323	1		
MP3	CONNECTOR,BACKSHELL	357020	89536	357020	1		
	DOU PCB ASSEMBLY						
	.FIGURE 602-3 (SHEET 2 OF 2)	ORDER	NEXT	HIGHER LEVEL	1		
H3	NUT,HEX 4-40	110635	73734	8003NP	1		
H4	SCREW,PHP,4-40 X 5/16	152116	73734	19024	1		
H5	WASHER,FLAT #4 PLATED	195909	73734	97405	1		
H6	WASHER,INT LOCK #4	110403	73734	99402	1		
MP4	CABLE CLAMP,3/16	101345	95987	3/16-3NA	1		
MP5	TERMINAL, CONN POST	376574	00779	3-87022-1	10		
MP6	COVER,CONNECTOR	450015	89536	450015	1		

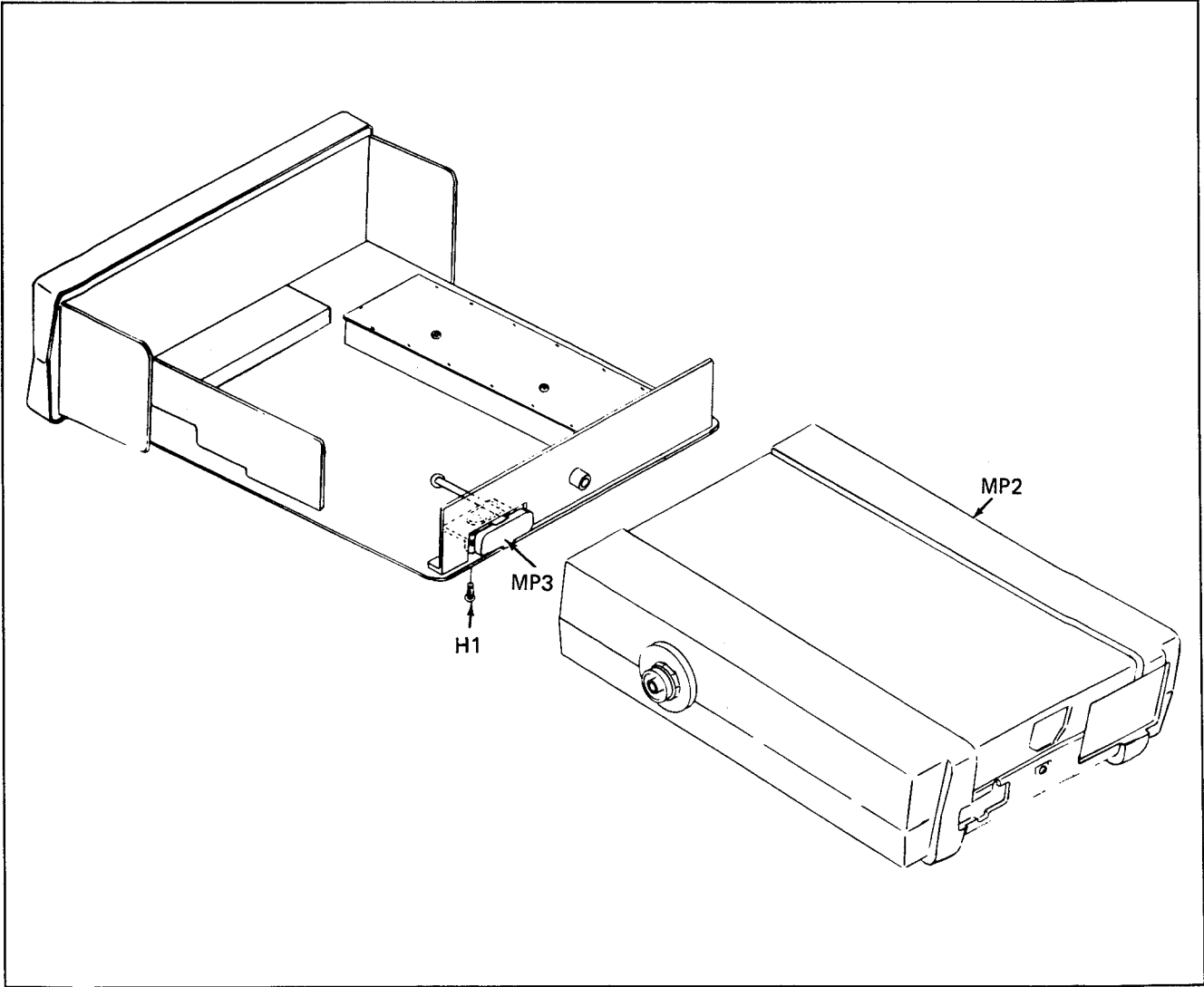


Figure 602-3. DOU Assembly (Sheet 1 of 2)

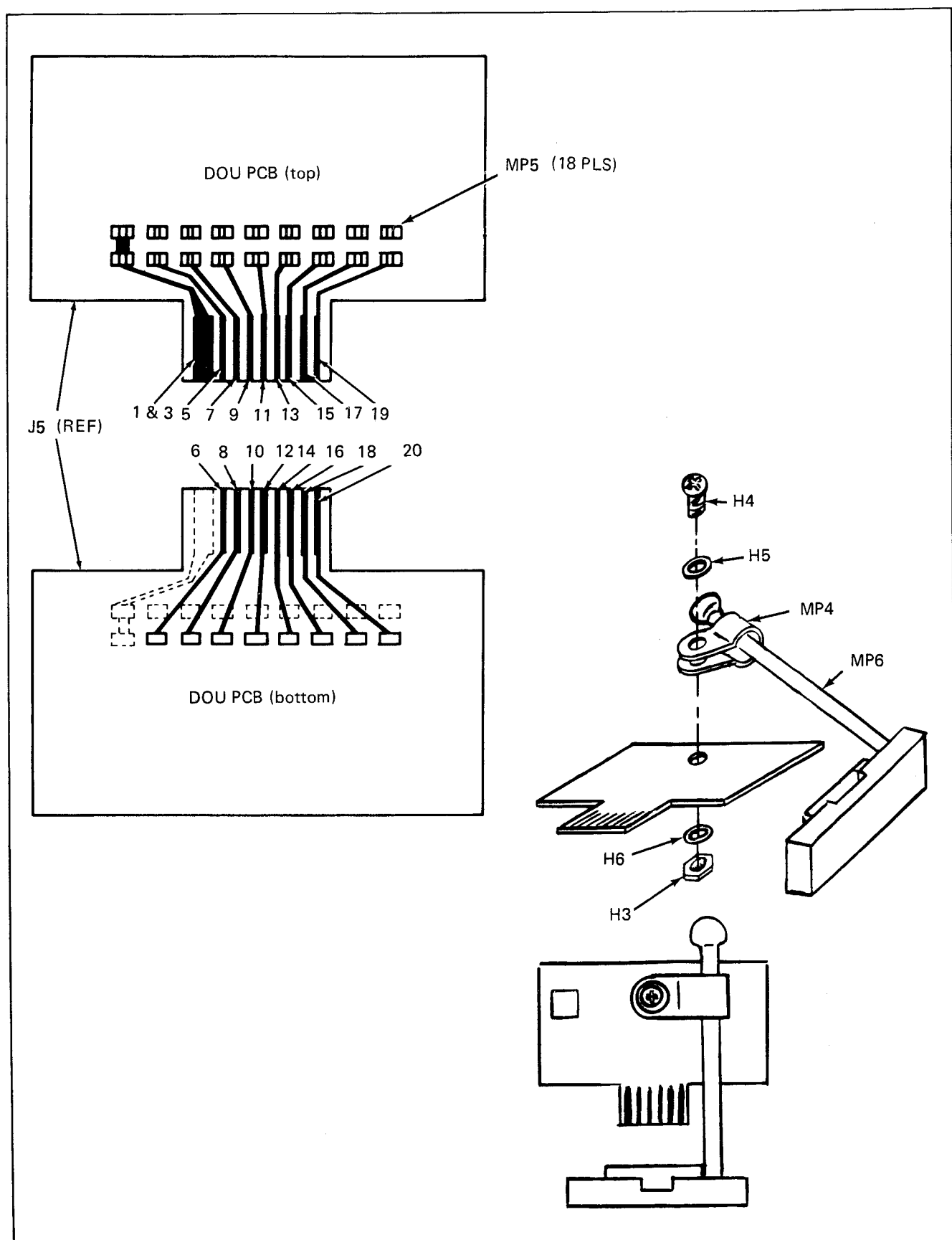


Figure 602-3. DOU Assembly Option -02 (Sheet 2 of 2)

## Option -03 TCXO

### 603-1. INTRODUCTION

603-2. Option —03 is a temperature compensated crystal oscillator (TCXO) which exhibits superior stability than the standard Y1 by using a neutralization circuit. The effects of the neutralization circuit on the crystals center frequency is shown in Figure 603-1. The resultant center frequency deviation (solid line) is held to a minimum over the designed temperature range. Within the desired temperature range the —03 affords a very stable output frequency as well as instantaneous warmup and low power consumption. However, if the temperature limits are exceeded, the crystal's stability will no longer be valid (See Section 1).

### 603-3. CALIBRATION

1. Allow the counter to operate for at least 30 minutes to stabilize the internal temperature.

2. Select the channel A frequency function, at 0.1 Hz resolution.
3. Connect the 10 MHz reference frequency to the channel A input.
4. Using a non-conductive screwdriver, adjust the TCXO through the rear panel. See component and test point location drawing in Section 4, to obtain a reading of overflow 000.000  $\pm 10$  digits.

### 603-4. LIST OF REPLACEABLE PARTS

603-5. The —03 TCXO is a completely sealed unit, containing no replaceable parts (See Figure 603-2).

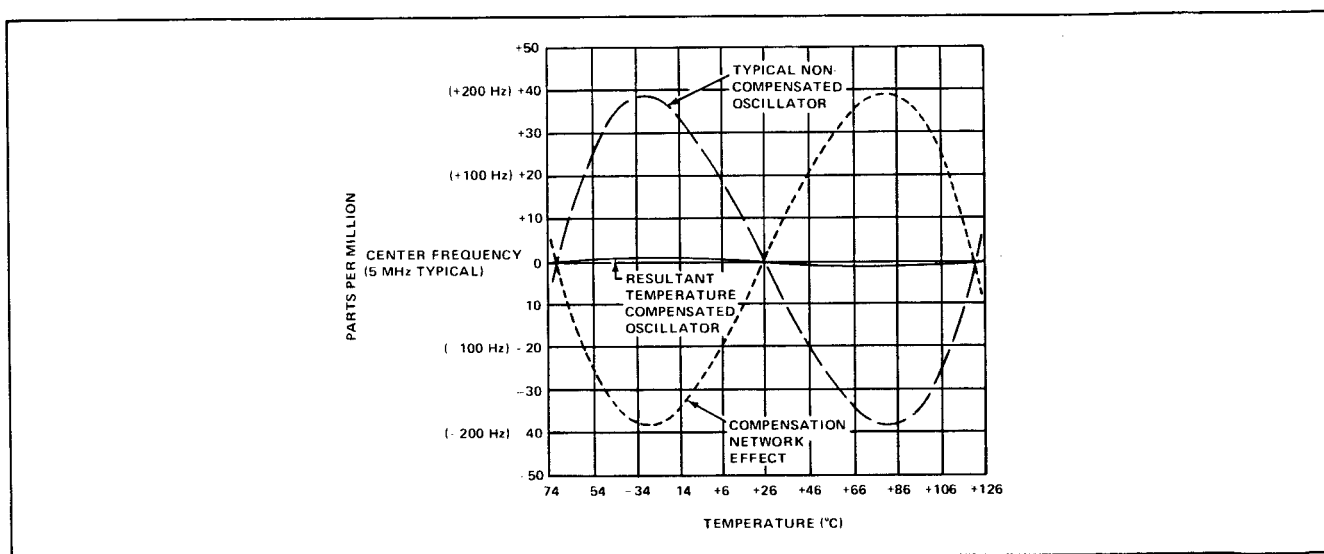


Table 603-1. -03/-04 TCXO Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
-04	SUPERIOR TCXO, FIGURE 603-2	ORDER	MODEL	1910A-04 OR 1911A-04	1		
-03	TCXO, FIGURE 603-2	ORDER	MODEL	1910A-03 OR 1911A-03	1		

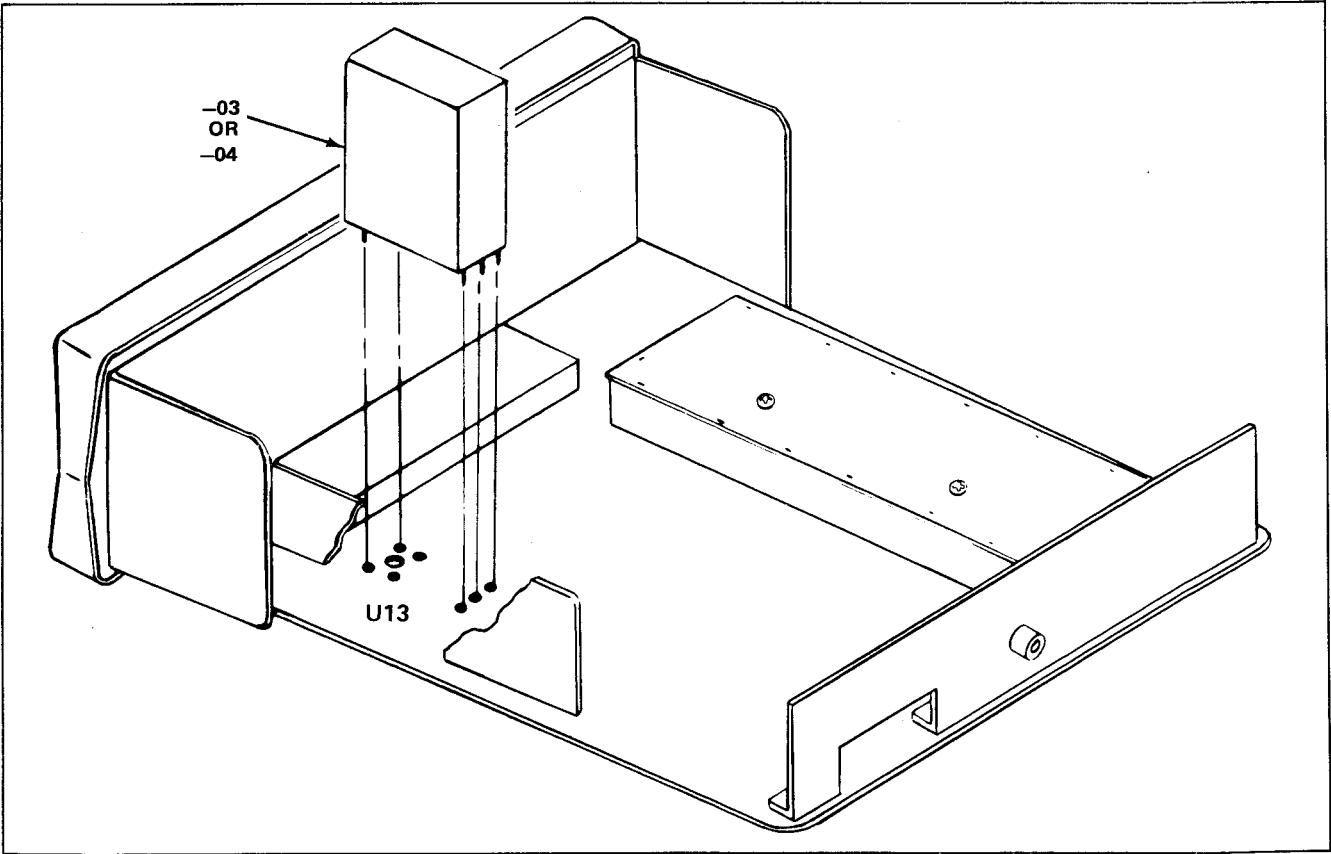


Figure 603-2. -03/-04 TCXO Assembly

## Option -04 TCXO (Superior)

### 604-1. INTRODUCTION

604-2. Option —04 is also a temperature compensated crystal oscillator which used the same neutralization scheme as the —03 Option (See Figure 603-1). However, because of tighter specifications, it is able to reduce its total deviation from the standard 10 MHz to approximately  $\frac{1}{4}$  of the —03's deviation, 0.5 ppm/month.

### 604-3. CALIBRATION

1. Allow the counter to operate for at least 3 hours to stabilize internal temperature.

2. Select the channel A frequency function at 0.1 Hz resolution.
3. Connect the 10 MHz reference frequency to the channel A input.
4. Using a non-conductive screwdriver adjust the TCXO through the rear panel, see component and test point location drawing in Section 4, to obtain a reading of  $000.0000 \pm 3$  digits.

### 604-4. LIST OF REPLACEABLE PARTS

- 604-5. The —04 TCXO is a completely sealed unit, containing no replaceable parts (See Figure 603-2).



## **Section 7**

# **General Information**

7-1. This section of the manual contains generalized user information as well as supplemental information to the List of Replaceable Parts contained in Section 5.

## List of Abbreviations and Symbols

<b>A or amp</b>	ampere	<b>hf</b>	high frequency	<b>(+) or pos</b>	positive
<b>ac</b>	alternating current	<b>Hz</b>	hertz	<b>pot</b>	potentiometer
<b>af</b>	audio frequency	<b>IC</b>	integrated circuit	<b>p-p</b>	peak-to-peak
<b>a/d</b>	analog-to-digital	<b>if</b>	intermediate frequency	<b>ppm</b>	parts per million
<b>assy</b>	assembly	<b>in</b>	inch(es)	<b>PROM</b>	programmable read-only memory
<b>AWG</b>	american wire gauge	<b>intl</b>	internal	<b>psi</b>	pound-force per square inch
<b>B</b>	bel	<b>I/O</b>	input/output	<b>RAM</b>	random-access memory
<b>bcd</b>	binary coded decimal	<b>k</b>	kilo ( $10^3$ )	<b>rf</b>	radio frequency
<b>°C</b>	Celsius	<b>kHz</b>	kilohertz	<b>rms</b>	root mean square
<b>cap</b>	capacitor	<b>k<math>\Omega</math></b>	kilohm(s)	<b>ROM</b>	read-only memory
<b>ccw</b>	counterclockwise	<b>kV</b>	kilovolt(s)	<b>s or sec</b>	second (time)
<b>cer</b>	ceramic	<b>lf</b>	low frequency	<b>scope</b>	oscilloscope
<b>cermet</b>	ceramic to metal(seal)	<b>LED</b>	light-emitting diode	<b>SH</b>	shield
<b>ckt</b>	circuit	<b>LSB</b>	least significant bit	<b>Si</b>	silicon
<b>cm</b>	centimeter	<b>LSD</b>	least significant digit	<b>serno</b>	serial number
<b>cmrr</b>	common mode rejection ratio	<b>M</b>	mega ( $10^6$ )	<b>sr</b>	shift register
<b>comp</b>	composition	<b>m</b>	milli ( $10^{-3}$ )	<b>Ta</b>	tantalum
<b>cont</b>	continue	<b>mA</b>	milliamperes(s)	<b>tb</b>	terminal board
<b>crt</b>	cathode-ray tube	<b>max</b>	maximum	<b>tc</b>	temperature coefficient or temperature compensating
<b>cw</b>	clockwise	<b>mf</b>	metal film	<b>tcxo</b>	temperature compensated crystal oscillator
<b>d/a</b>	digital-to-analog	<b>MHz</b>	megahertz	<b>tp</b>	test point
<b>dac</b>	digital-to-analog converter	<b>min</b>	minimum	<b>u or <math>\mu</math></b>	micro ( $10^{-6}$ )
<b>dB</b>	decibel	<b>mm</b>	millimeter	<b>uhf</b>	ultra high frequency
<b>dc</b>	direct current	<b>ms</b>	millisecond	<b>us or <math>\mu</math>s</b>	microsecond(s) ( $10^{-6}$ )
<b>dmm</b>	digital multimeter	<b>MSB</b>	most significant bit	<b>uut</b>	unit under test
<b>dvm</b>	digital voltmeter	<b>MSD</b>	most significant digit	<b>V</b>	volt
<b>elect</b>	electrolytic	<b>MTBF</b>	mean time between failures	<b>v</b>	voltage
<b>ext</b>	external	<b>MTTR</b>	mean time to repair	<b>var</b>	variable
<b>F</b>	farad	<b>mV</b>	millivolt(s)	<b>vco</b>	voltage controlled oscillator
<b>°F</b>	Fahrenheit	<b>mv</b>	multivibrator	<b>vhf</b>	very high frequency
<b>FET</b>	Field-effect transistor	<b>M<math>\Omega</math></b>	megohm(s)	<b>vlf</b>	very low frequency
<b>ff</b>	flip-flop	<b>n</b>	nano ( $10^{-9}$ )	<b>W</b>	watt(s)
<b>freq</b>	frequency	<b>na</b>	not applicable	<b>ww</b>	wire wound
<b>FSN</b>	federal stock number	<b>NC</b>	normally closed	<b>xfmr</b>	transformer
<b>g</b>	gram	<b>(-) or neg</b>	negative	<b>xstr</b>	transistor
<b>G</b>	giga ( $10^9$ )	<b>NO</b>	normally open	<b>xtal</b>	crystal
<b>gd</b>	guard	<b>ns</b>	nanosecond	<b>xtlo</b>	crystal oscillator
<b>Ge</b>	germanium	<b>opnl ampl</b>	operational amplifier	<b><math>\Omega</math></b>	ohm(s)
<b>GHz</b>	gigahertz	<b>p</b>	pico ( $10^{-12}$ )	<b><math>\mu</math></b>	micro ( $10^{-6}$ )
<b>gmV</b>	guaranteed minimum value	<b>para</b>	paragraph		
<b>gnd</b>	ground	<b>pcb</b>	printed circuit board		
<b>H</b>	henry	<b>pF</b>	picofarad		
<b>hd</b>	heavy duty	<b>pn</b>	part number		

# Federal Supply Codes for Manufacturers

00213 Nytronics Comp. Group Inc. Subsidiary of Nytronics Inc. Formerly Sage Electronics Rochester, New York	02660 Bunker Ramo Corp., Conn Div. Formerly Amphenol-Borg Electric Corp. Broadview, Illinois	04946 Standard Wire & Cable Los Angeles, California	06751 Components, Inc. Semcor Div. Phoenix, Arizona
00327 Welwyn International, Inc. Westlake, Ohio	02799 Areo Capacitors, Inc. Chatsworth, California	05082 Replaced by 94988	06860 Gould Automotive Div. City of Industry, California
00656 Aerovox Corp. New Bedford, Massachusetts	03508 General Electric Co. Semiconductor Products Syracuse, New York	05236 Jonathan Mfg. Co. Fullerton, California	06961 Vernitron Corp., Piezo Electric Div. Formerly Clevite Corp., Piezo Electric Div. Bedford, Ohio
00686 Film Capacitors, Inc. Passaic, New Jersey	03614 Replaced by 71400	05245 Components Corp. now Corcom, Inc. Chicago, Illinois	06980 Eimac Div. Varian Associates San Carlos, California
00779 AMP Inc. Harrisburg, Pennsylvania	03651 Replaced by 44655	05277 Westinghouse Electric Corp. Semiconductor Div. Youngwood, Pennsylvania	07047 The Ross Milton Co. South Hampton, Pennsylvania
01121 Allen-Bradley Co. Milwaukee, Wisconsin	03797 Eldema Div. Genisco Technology Corp. Compton, California	05278 Replaced by 43543	07115 Replaced by 14674
01281 TRW Electronic Comp. Semiconductor Operations Lawndale, California	03877 Transistron Electronic Corp. Wakefield, Massachusetts	05279 Southwest Machine & Plastic Co. Glendora, California	07138 Westinghouse Electric Corp., Electronic Tube Div. Horsehead, New York
01295 Texas Instruments, Inc. Semiconductor Group Dallas, Texas	03888 KDI Pyrofilm Corp. Whippany, New Jersey	05397 Union Carbide Corp. Materials Systems Div. New York, New York	07233 TRW Electronic Components Cinch Graphic City of Industry, California
01537 Motorola Communications & Electronics Inc. Franklin Park, Illinois	03911 Clairex Electronics Div. Clairex Corp. Mt. Vernon, New York	05571 Use 56289 Sprague Electric Co. Pacific Div. Los Angeles, California	07256 Silicon Transistor Corp. Div. of BBF Group Inc. Chelmsford, Massachusetts
01686 RCL Electronics Inc. Manchester, New Hampshire	03980 Muirhead Inc. Mountainside, New Jersey	05574 Viking Industries Chatsworth, California	07261 Aumet Corp. Culver City, California
01730 Replaced by 73586	04009 Arrow Hart Inc. Hartford, Connecticut	05704 Replaced by 16258	07263 Fairchild Semiconductor Div. of Fairchild Camera & Instrument Corp. Mountain View, California
01884 Use 56289 Sprague Electric Co. Dearborn Electronic Div. Lockwood, Florida	04062 Replaced by 72136	05820 Wakefield Engineering Inc. Wakefield, Massachusetts	07344 Bircher Co., Inc. Rochester, New York
02114 Ferroxcube Corp. Saugerties, New York	04202 Replaced by 81312	06001 General Electric Co. Electronic Capacitor & Battery Products Dept. Columbia, South Carolina	07597 Burndy Corp. Tape/Cable Div. Rochester, New York
02121 General Instrument Corp. Harris ASW Div. Westwood, Maine	04217 Essex International Inc. Wire & Cable Div. Anaheim, California	06136 Replaced by 63743	07792 Lerma Engineering Corp. Northampton, Massachusetts
02395 Rason Mfg. Co. Brooklyn, New York	04221 Aemco, Div. of Midtex Inc. Mankato, Minnesota	06383 Panduit Corp. Tinley Park, Illinois	07910 Teledyne Semiconductor Formerly Continental Device Hawthorne, California
02533 Snelgrove, C.R. Co., Ltd. Don Mills, Ontario, Canada M3B 1M2	04222 AVX Ceramics Div. AVX Corp. Myrtle Beach, Florida	06473 Bunker Ramo Corp. Amphenol SAMS Div. Chatsworth, California	07933 Use 49956 Raytheon Co. Semiconductor Div. HQ Mountain View, California
02606 Fenwal Labs Div. of Travenal Labs. Morton Grove, Illinois	04423 Telonic Industries Laguna Beach, California	06555 Beede Electrical Instrument Co. Penacook, New Hampshire	08225 Industro Transistor Corp. Long Island City, New York
	04645 Replaced by 75376	06739 Electron Corp. Littleton, Colorado	
	04713 Motorola Inc. Semiconductor Products Phoenix, Arizona	06743 Clevite Corp. Cleveland, Ohio	

# Federal Supply Codes for Manufacturers (cont)

08261 Spectra Strip Corp. Garden Grove, California	11726 Qualidyne Corp. Santa Clara, California	13606 Use 56289 Sprague Electric Co. Transistor Div. Concord, New Hampshire	16299 Corning Glass Electronic Components Div. Raleigh, North Carolina
08530 Reliance Mica Corp. Brooklyn, New York	12014 Chicago Rivet & Machine Co. Bellwood, Illinois	13839 Replaced by 23732	16332 Replaced by 28478
08806 General Electric Co. Miniature Lamp Products Dept Cleveland, Ohio	12040 National Semiconductor Corp. Danbury, Connecticut	14099 Semtech Corp. Newbury Park, California	16473 Cambridge Scientific Ind. Div. of Chemed Corporation Cambridge, Maryland
08863 Nylomatic Corp. Norrisville, Pennsylvania	12060 Diodes, Inc. Chatsworth, California	14140 Edison Electronic Div. Mc Gray-Edison Co. Manchester, New Hampshire	16742 Paramount Plastics Fabricators, Inc. Downey, California
08988 Use 53085 Skottie Electronics Inc. Archbald, Pennsylvania	12136 Philadelphia Handle Co. Camden, New Jersey	14193 Cal-R-Inc. formerly California Resistor, Corp. Santa Monica, California	16758 Delco Electronics Div. of General Motors Corp. Kokomo, Indiana
09214 G.E. Co. Semi-Conductor Products Dept. Power Semi-Conductor Products OPN Sec. Auburn, New York	12300 Potter-Brumfield Div. AMF Canada LTD. Guelph, Ontario, Canada	14298 American Components, Inc. an Insilco Co. Conshohocken, Pennsylvania	17001 Replaced by 71468
09353 C and K Components Watertown, Massachusetts	12323 Presin Co., Inc. Shelton, Connecticut	14655 Cornell-Dublier Electronics Division of Federal Pacific Electric Co. Govt. Control Dept. Newark, New Jersey	17069 Circuit Structures Lab. Burbank, California
09423 Scientific Components, Inc. Santa Barbara, California	12327 Freeway Corp. formerly Freeway Washer & Stamping Co. Cleveland, Ohio	14752 Electro Cube Inc. San Gabriel, California	17338 High Pressure Eng. Co., Inc. Oklahoma City, Oklahoma
09922 Burndy Corp. Norwalk, Connecticut	12443 The Budd Co. Polychem Products Plastic Products Div. Bridgeport, Pennsylvania	14869 Replaced by 96853	17545 Atlantic Semiconductors, Inc. Asbury Park, New Jersey
09969 Dale Electronics Inc. Yankton, S. Dakota	12615 U.S. Terminals Inc. Cincinnati, Ohio	14936 General Instrument Corp. Semi Conductor Products Group Hicksville, New York	17856 Siliconix, Inc. Santa Clara, California
10059 Barker Engineering Corp. Formerly Amerace, Amerace ESNA Corp. Kenilworth, New Jersey	12617 Hamlin Inc. Lake Mills, Wisconsin	15636 Elec-Trol Inc. Saugus, California	17870 Replaced by 14140
11236 CTS of Berne Berne, Indiana	12697 Clarostat Mfg. Co. Dover, New Hampshire	15801 Fenwal Electronics Inc. Div. of Kidde Walter and Co., Inc. Framingham, Massachusetts	18178 Vactec Inc. Maryland Heights, Missouri
11237 CTS Keene Inc. Paso Robles, California	12749 James Electronics Chicago, Illinois	15818 Teledyne Semiconductors, formerly Amelco Semiconductor Mountain View, California	18324 Signetics Corp. Sunnyvale, California
11358 CBS Electronic Div. Columbia Broadcasting System Newburyport, Minnesota	12856 Micrometals Sierra Madre, California	15849 Litton Systems Inc. Useco Div. formerly Useco Inc. Van Nuys, California	18612 Vishay Resistor Products Div. Vishay Intertechnology Inc. Malvern, Pennsylvania
11403 Best Products Co. Chicago, Illinois	12954 Dickson Electronics Corp. Scottsdale, Arizona	15898 International Business Machines Corp. Essex Junction, Vermont	18736 Voltronics Corp. Hanover, New Jersey
11503 Keystone Columbia Inc. Warren, Michigan	12969 Unitrode Corp. Watertown, Massachusetts	15909 Replaced by 14140	18927 GTE Sylvania Inc. Precision Material Group Parts Division Titusville, Pennsylvania
11532 Teledyne Relays Hawthorne, California	13103 Thermalloy Co., Inc. Dallas, Texas	16258 Space-Lok Inc. Burbank, California	19451 Perine Machinery & Supply Co. Seattle, Washington
11711 General Instrument Corp. Rectifier Division Hicksville, New York	13327 Solitron Devices Inc. Tappan, New York		19701 Electro-Midland Corp. Mepco-Electra Inc. Mineral Wells, Texas
	13511 Amphenol Cadre Div. Bunker-Ramo Corp. Los Gatos, California		20584 Enochs Mfg. Inc. Indianapolis, Indiana

### Federal Supply Codes for Manufacturers (cont)

20891 Self-Organizing Systems, Inc. Dallas, Texas	28480 Hewlett Packard Co. Corporate HQ Palo Alto, California	43543 Nytronics Inc. Transformer Co. Div. Geneva, New York	70903 Belden Corp. Geneva, Illinois
21604 Bucheys Stamping Co. Columbus, Ohio	28520 Heyman Mfg. Co. Kenilworth, New Jersey	44655 Ohmite Mfg. Co. Skokie, Illinois	71002 Birnbach Radio Co., Inc. Freeport, New York
21845 Solitron Devices Inc. Transistor Division Riveria Beach, Florida	29083 Monsanto, Co., Inc. Santa Clara, California	49671 RCA Corp. New York, New York	71400 Bussmann Mfg. Div. of McGraw-Edison Co. Saint Louis, Missouri
22767 ITT Semiconductors Palo Alto, California	29604 Stackpole Components Co. Raleigh, North Carolina	49956 Raytheon Company Lexington, Massachusetts	71450 CTS Corp. Elkhart, Indiana
23050 Product Comp. Corp. Mount Vernon, New York	30148 AB Enterprise Inc. Ahoskie, North Carolina	50088 Mostek Corp. Carrollton, Texas	71468 ITT Cannon Electric Inc. Santa Ana, California
23732 Tracor Inc. Rockville, Maryland	30323 Illinois Tool Works, Inc. Chicago, Illinois	50579 Litronix Inc. Cupertino, California	71482 Clare, C.P. & Co. Chicago, Illinois
23880 Stanford Applied Engrng. Santa Clara, California	31091 Optimax Inc. Colmar, Pennsylvania	51605 Scientific Components Inc. Linden, New Jersey	71590 Centrelab Electronics Div. of Globe Union Inc. Milwaukee, Wisconsin
23936 Pamotor Div., Wm. J. Purdy Co. Burlingame, California	32539 Mura Corp. Great Neck, New York	53021 Sangamo Electric Co. Springfield, Illinois	71707 Coto Coil Co., Inc. Providence, Rhode Island
24248 Replaced by 94222	32767 Griffith Plastic Corp. Burlingame, California	54294 Cutler-Hammer Inc. formerly Shallcross, A Cutter-Hammer Co. Selma, North Carolina	71744 Chicago Miniature Lamp Works Chicago, Illinois
24355 Analog Devices Inc. Norwood, Massachusetts	32879 Advanced Mechanical Components Northridge, California	55026 Simpson Electric Co. Div. of Am. Gage and Mach. Co. Elgin, Illinois	71785 TRW Electronics Components Cinch Connector Operations Div. Elk Grove Village Chicago, Illinois
24655 General Radio Concord, Massachusetts	32897 Erie Technological Products, Inc. Frequency Control Div. Carlisle, Pennsylvania	56289 Sprague Electric Co. North Adams, Massachusetts	72005 Wilber B. Driver Co. Newark, New Jersey
24759 Lenox-Fugle Electronics Inc. South Plainfield, New Jersey	32997 Bourns Inc. Trimpot Products Division Riverside, California	58474 Superior Electric Co. Bristol, Connecticut	72092 Replaced by 06980
25088 Siemen Corp. Isilen, New Jersey	33173 General Electric Co. Products Dept. Owensboro, Kentucky	60399 Torin Corp. formerly Torrington Mfg. Co. Torrington, Connecticut	72136 Electro Motive Mfg. Co. Williamantic, Connecticut
25403 Amperex Electronic Corp. Semiconductor & Micro-Circuits Div. Slatersville, Rhode Island	34333 Silicon General Westminister, California	63743 Ward Leonard Electric Co., Inc. Mount Vernon, New York	72259 Nytronics Inc. Pelham Manor, New Jersey
27014 National Semiconductor Corp. Santa Clara, California	34335 Advanced Micro Devices Sunnyvale, California	64834 West Mfg. Co. San Francisco, California	72619 Dialight Div. Amperex Electronic Corp. Brooklyn, New York
27264 Molex Products Downers Grove, Illinois	34802 Electromotive Inc. Kenilworth, New Jersey	65092 Weston Instruments Inc. Newark, New Jersey	72653 G.C. Electronics Div. of Hydrometals, Inc. Brooklyn, New York
28213 Minnesota Mining & Mfg. Co. Consumer Products Div. St. Paul, Minnesota	37942 P.R. Mallory & Co., Inc. Indianapolis, Indiana	66150 Winslow Tele-Tronics Inc. Eaton Town, New Jersey	72665 Replaced by 90303
28425 Serv-/Link formerly Bohannon Industries Fort Worth, Texas	42498 National Radio Melrose, Massachusetts	70485 Atlantic India Rubber Works Chicago, Illinois	72794 Dzus Fastener Co., Inc. West Islip, New York
28478 Deltrol Controls Div. Deltrol Corporation Milwaukee, Wisconsin		70563 Amperite Company Union City, New Jersey	72928 Gulton Ind. Inc. Gudeman Div. Chicago, Illinois

# Federal Supply Codes for Manufacturers (cont)

72982 Erie Tech. Products Inc. Erie, Pennsylvania	75382 Kulka Electric Corp. Mount Vernon, New York	80583 Hammarlund Mfg. Co., Inc. Red Bank, New Jersey	83594 Burroughs Corp. Electronic Components Div. Plainfield, New Jersey
73138 Bechman Instrument Inc. Helipot Division Fullerton, California	75915 Littlefuse Inc. Des Plaines, Illinois	80640 Arnold Stevens, Inc. South Boston, Massachusetts	83740 Union Carbide Corp. Battery Products Div. formerly Consumer Products Div. New York, New York
73293 Hughes Aircraft Co. Electron Dynamics Div. Torrance, California	76854 Oak Industries Inc. Switch Div. Crystal Lake, Illinois	81073 Grayhill, Inc. La Grange, Illinois	84171 Arco Electronics Great Neck, New York
73445 Amperex Electronic Corp. Hicksville, New York	77342 AMF Inc. Potter & Brumfield Div. Princeton, Indiana	81312 Winchester Electronics Div. of Litton Industries Inc. Oakville, Connecticut	84411 TRW Electronic Components TRW Capacitors Ogallala, Nebraska
73559 Carling Electric Inc. West Hartford, Connecticut	77638 General Instrument Corp. Rectifier Division Brooklyn, New York	81483 Therm-O-Disc Inc. Mansfield, Ohio	84613 Fuse Indicator Corp. Rockville, Maryland
73586 Circle F Industries Trenton, New Jersey	77969 Rubbercraft Corp. of CA. LTD. Torrance, California	81483 International Rectifier Corp. Los Angeles, California	84682 Essex International Inc. Industrial Wire Div. Seabody, Massachusetts
73734 Federal Screw Products, Inc. Chicago, Illinois	78189 Shakeproof Div. of Illinois Tool Works Inc. Elgin, Illinois	81590 Korry Mfg. Co. Seattle, Washington	86577 Precision Metal Products of Malden Inc. Stoneham, Massachusetts
73743 Fischer Special Mfg. Co. Cincinnati, Ohio	78277 Sigma Instruments, Inc. South Braintree, Massachusetts	81741 Chicago Lock Co. Chicago, Illinois	86684 Radio Corp. of America Electronic Components Div. Harrison, New Jersey
73899 JFD Electronics Co. Components Corp. Brooklyn, New York	78488 Stackpole Carbon Co. Saint Marys, Pennsylvania	82305 Palmer Electronics Corp. South Gate, California	86928 Seastrom Mfg. Co., Inc. Glendale, California
73949 Guardian Electric Mfg. Co. Chicago, Illinois	78553 Eaton Corp. Engineered Fastener Div. Tinnerman Plant Cleveland, Ohio	82389 Switchcraft Inc. Chicago, Illinois	87034 Illuminated Products Inc. Subsidiary of Oak Industries Inc. Anaheim, California
74199 Quan Nichols Co. Chicago, Illinois	79136 Waldes Kohinoor Inc. Long Island City, New York	82415 North American Phillips Controls Corp. Frederick, Maryland	88219 Gould Inc. Industrial Div. Trenton, New Jersey
74217 Radio Switch Corp. Marlboro, New Jersey	79497 Western Rubber Company Goshen, Indiana	82872 Roanwell Corp. New York, New York	88245 Litton Systems Inc. Usecu Div. Van Nuys, California
74276 Signalite Div. General Instrument Corp. Neptune, New Jersey	79963 Zierick Mfg. Corp. Mt. Kisko, New York	82877 Rotron Inc. Woodstock, New York	88419 Cornell-Dubilier Electronic Div. Federal Pacific Co. Fuquay-Varian, North Carolina
74306 Piezo Crystal Co. Carlisle, Pennsylvania	80031 Electro-Midland Corp. Mepco Div. A North American Phillips Co. Norristown, New Jersey	82879 ITT Royal Electric Div. Pawtucket, Rhode Island	88486 Plastic Wire & Cable Jewitt City, Connecticut
74542 Hoyt Elect. Instr. Works Penacook, New Hampshire	80145 LFE Corp., Process Control Div. formerly API Instrument Co. Chesterland, Ohio	83003 Varo Inc. Garland, Texas	88690 Replaced by 04217
74970 Johnson E.F., Co. Waseca, Minnesota	80183 Use 56289 Sprague Products North Adams, Massachusetts	83058 The Carr Co., United Can Div. of TRW Cambridge, Massachusetts	89536 John Fluke Mfg. Co., Inc. Seattle, Washington
75042 TRW Electronics Components IRC Fixed Resistors Philadelphia, Pennsylvania	80294 Bourns Inc., Instrument Div. Riverside, California	83298 Bendix Corp. Electric Power Div. Eatontown, New Jersey	89730 G.E. Co., Newark Lamp Works Newark, New Jersey
75376 Kurz-Kasch Inc. Dayton, Ohio		83330 Herman H. Smith, Inc. Brooklyn, New York	
75378 CTS Knights Inc. Sandwich, Illinois		83478 Rubbercraft Corp. of America, Inc. West Haven, Connecticut	

### Federal Supply Codes for Manufacturers (cont)

90201 Mallory Capacitor Co. Div. of P.R. Mallory Co., Inc. Indianapolis, Indiana	91836 King's Electronics Co., Inc. Tuckahoe, New York	95354 Methode Mfg. Corp. Rolling Meadows, Illinois	98291 Seaelectro Corp. Mamaroneck, New York
90211 Use 56365 Square D Co. Chicago, Illinois	91929 Honeywell Inc. Micro Switch Div. Freeport, Illinois	95712 Bendix Corp. Electrical Components Div. Microwave Devices Plant Franklin, Indiana	98388 Royal Industries Products Div. San Diego, California
90215 Best Stamp & Mfg. Co. Kansas City, Missouri	91934 Miller Electric Co., Inc. Div. of Aunet Woonsocket, Rhode Island	95987 Weckesser Co. Inc. Chicago, Illinois	98743 Replaced by 12749
90303 Mallory Battery Co. Div. of Mallory Co., Inc. Tarrytown, New York	92194 Alpha Wire Corp. Elizabeth, New Jersey	96733 San Fernando Electric Mfg. Co. San Fernando, California	98925 Replaced by 14433
91094 Essex International Inc. Suglex/IWP Div. Newmarket, New Hampshire	93332 Sylvania Electric Products Semiconductor Products Div. Woburn, Massachusetts	96853 Gulton Industries Inc. Measurement and Controls Div. formerly Rustrak Instruments Co. Manchester, New Hampshire	99120 Plastic Capacitors, Inc. Chicago, Illinois
91293 Johanson Mfg. Co. Boonton, New Jersey	94145 Replaced by 49956	96881 Thomson Industries, Inc. Manhasset, New York	99217 Bell Industries Elect. Comp. Div. formerly Southern Elect. Div. Burbank, California
91407 Replaced by 58474	94154 Use 94988 Wagner Electric Corp. Tung-Sol Div. Newark, New Jersey	97540 Master Mobile Mounts, Div. of Whitehall Electronics Corp. Ft. Meyers, Florida	99392 STM Oakland, California
91502 Associated Machine Santa Clara, California	94222 Southco Inc. formerly South Chester Corp. Lester, Pennsylvania	97913 Industrial Electronic Hardware Corp. New York, New York	99515 ITT Jennings Monrovia Plant Div. of ITT Jennings formerly Marshall Industries Capacitor Div. Monrovia, California
91506 Augat Inc. Attleboro, Massachusetts	95146 Alco Electronic Products Inc. Lawrence, Massachusetts	97945 Penwalt Corp. SS White Industrial Products Div. Piscataway, New Jersey	99779 Use 29587 Bunker-Ramo Corp. Barnes Div. Landsdowne, Pennsylvania
91637 Dale Electronics Inc. Columbus, Nebraska	95263 Leecraft Mfg. Co. Long Island City, New York	97966 Replaced by 11358	99800 American Precision Industries Inc. Delevan Division East Aurora, New York
91662 Elco Corp. Willow Grove, Pennsylvania	95264 Replaced by 98278	98094 Replaced by 49956	99942 Centrelab Semiconductor Centrelab Electronics Div. of Globe-Union Inc. El Monte, California
91737 Use 71468 Gremar Mfg. Co., Inc. ITT Cannon/Gremar Santa Ana, California	95275 Vitramon Inc. Bridgeport, Connecticut	98159 Rubber-Teck, Inc. Gardena, California	Toyo Electronics (R-Ohm Corp.) Irvine, California
91802 Industrial Devices, Inc. Edgewater, New Jersey	95303 RCA Corp. Receiving Tube Div. Cincinnati, Ohio	98278 Malco A Microdot Co., Inc. Connector & Cable Div. Pasadena, California	National Connector Minneapolis, Minnesota
91833 Keystone Electronics Corp. New York, New York	95348 Gordo's Corp. Bloomfield, New Jersey		

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## AZ, Tempe

John Fluke Mfg. Co., Inc.  
2211 S. 48th Street  
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Tempe, AZ 85282  
(602) 438-8314

## CA, Burbank

John Fluke Mfg. Co., Inc.  
2020 N. Lincoln Street  
Burbank, CA 91504  
(213) 849-7181

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Irvine, CA 92713-9676  
16969 Von Karman  
Suite 100  
Irvine, CA 92714  
(714) 863-9031

## San Diego

John Fluke Mfg. Co., Inc.  
4540 Kearny Villa Road  
Suite 115  
San Diego, CA 92123  
(619) 292-7656

## Santa Clara

John Fluke Mfg. Co., Inc.  
2300 Walsh Ave., Bldg. K  
Santa Clara, CA 95051  
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John Fluke Mfg. Co., Inc.  
14180 E. Evans Ave.  
Aurora, CO 80014  
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## CT, Hartford

John Fluke Mfg. Co., Inc.  
Glen Lochen East  
41-C New London Turnpike  
Glastonbury, CT 06033  
(203) 659-3541

## FL, Clearwater

(813) 799-0087

## Orlando

John Fluke Mfg. Co., Inc.  
940 N. Fern Creek Ave.  
Orlando, FL 32803  
(305) 896-4881

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## GA, Atlanta

John Fluke Mfg. Co., Inc.  
2600 Delk Road  
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(404) 953-4747

## IL, Chicago

John Fluke Mfg. Co., Inc.  
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(312) 392-9510

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John Fluke Mfg. Co., Inc.  
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(301) 770-1570

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John Fluke Mfg. Co., Inc.  
33031 Schoolcraft  
Livonia, MI 48150  
(313) 522-9140

## MN, Bloomington

John Fluke Mfg. Co., Inc.  
1801 E. 79th St., Suite 9  
Bloomington, MN 55420  
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## MO, St. Louis

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West 75 Century Road  
Paramus, NJ 07652  
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CO, Denver (303) 695-1000  
FL, Orlando (305) 896-4881  
IL, Chicago (312) 392-9510  
MA, Billerica (617) 663-2400  
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From Alaska, Hawaii, or Washington phone (206) 356-5400. From Canada and other countries phone (206) 356-5500.



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Elmeasco Instruments Pty, Ltd.  
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Elmeasco Instruments Pty, Ltd.  
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Vertrieb KG  
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Manama, Bahrain  
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## Appendix 7A

### Manual Change Information

#### INTRODUCTION

This appendix contains information necessary to backdate the manual to conform with earlier pcn configurations. To identify the configuration of the pcb's used in your instrument, refer to the revision letter (marked in ink) on the component side of each pcb assembly. Table 7A-1 defines the assembly revision levels documented in this manual with an X.

#### NEWER INSTRUMENTS

As changes and improvements are made to the instrument they are identified by incrementing the revision letter marked on the affected pcb assembly. These changes are documented on a supplemental change/errata sheet which, when applicable, is inserted at the front of the manual.

#### OLDER INSTRUMENTS

To backdate this manual to conform with earlier assembly revision levels, perform the changes indicated in Table 7A-1.

Table 7A-1. Manual Status and Backdating Information

Ref Or Option No.	Assembly Name	Fluke Part No.	To adapt manual to earlier rev configurations perform changes in descending order (by no.), ending with change under desired rev letter																		
			-	A	B	C	D	E	F	G	H	J	K	L	M	N	P	D-1			
A1	Main PCB (115, 230V)	443366					1	3	7	X								2			
A1	Main PCB (100V)	456954					1	3	7	X								2			
A1	Main PCB -01	443523					1	3	7	X								2			
A1A2	Display PCB	443358			X																
A1A3	Prescaler PCB	443341					4	5	X												
A2	Inverter PCB	443333			X																
A3	AC PCB (115V, 58-62 Hz)	456251			6	X															
A3	AC PCB (230V, 48-52 Hz)	459362			6	X															
A3	AC PCB (100V, 48-52 Hz)	459370		6	X																
A3	AC PCB (100V, 58-62 Hz)	463307	6	X																	

X = The PCB revision levels documented in this manual.

■ = These revision letters were never used in the instrument.

- = No revision letter on the PCB.

**CHANGE #1—11131**

**Make indicated changes to Main PCB parts list.**

**Delete following items:**

U15 P/N 402610, R51 P/N 348920, R52 P/N 348839

**Add following items:**

R18 P/N 348821

**Modify following items:**

R20 10k pot P/N 309674, to R20 1.8k P/N 441444.

R39 10k P/N 348839, to R39 100k P/N 348920.

R38 1k P/N 343426, to R38 10k P/N 348839.

R17 22k P/N 348870, to R17 4.7k P/N 348821.

C32 0.01 uF P/N 149153 to C32 10 uF P/N 193623.

**MAKE INDICATED CHANGES TO TEXT, WHERE SPECIFIED.**

**Delete following items:**

Paragraph 4-24.

**Add following items:**

Paragraph 4-24, below.

### **23. Trigger Level Adjustment (Channel A)**

24. The trigger level adjustments should be performed whenever repairs have been made to the input section the counter. Perform the trigger level adjustment as follows:

1. Remove the instrument from it's case.
2. Energize the counter (refer to #1 warning under general maintenance of Section 4) connect the high frequency generator and an RF millivoltmeter via a T-connector terminated into 50Ω to the channel A input.
3. Set the front panel trigger level control to the preset position.
4. Set the generator to 75 mV output level at about 100 MHz. Note the display reading as a reference.
5. Reduce the input level until the display becomes unstable and then try to adjust R11 (internal trigger level, see Figure 4-1) for the reference reading as noted in step 4.
6. Repeat step 4 and 5 until no additional sensitivity is possible. The display must remain as noted in step 4, with an input level below 75 mV.

**MAKE INDICATED CHANGES TO ALL SCHEMATICS, DIAGRAMS AND FIGURES AS FOLLOWS:**

**Delete following items from Figures: 5-2, 601-2, 8-1 and 8-2 (sheet 2 & 3)**

U15, R51, R20 and its ground, R52, ground from C28 and +5V from R38.

**Add following items to Figures: 5-2, 601-2, 8-1 and if applicable 8-2 (sheet 2 & 3).**

HYST line, see Figure 1

R20 1.2k, see Figure 2

R18 4.7k, see Figure 2

+5V to C28, see Figure 3

Ground to R38 10k, see Figure 3

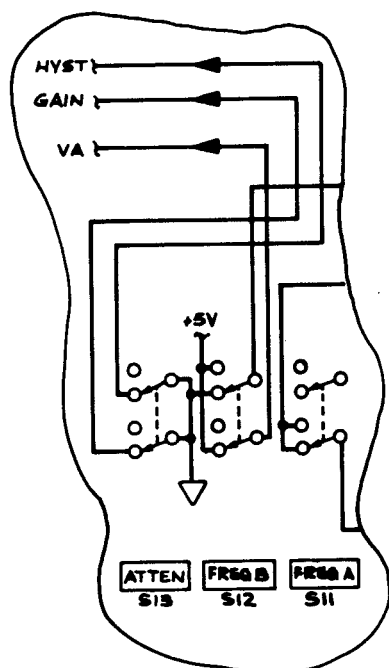


FIGURE -1

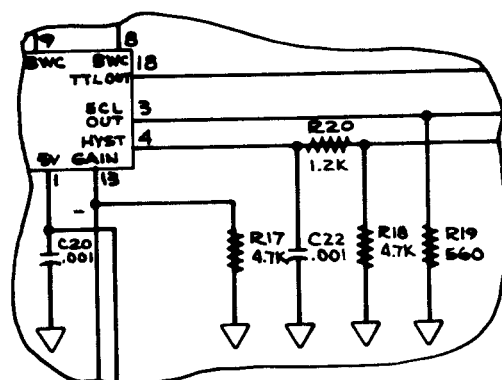


FIGURE -2

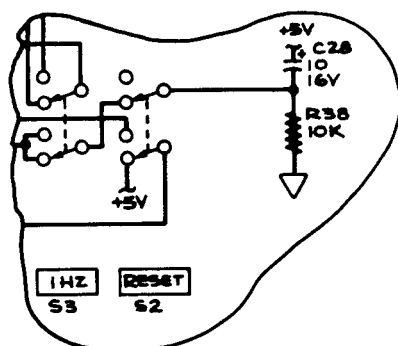


FIGURE -3

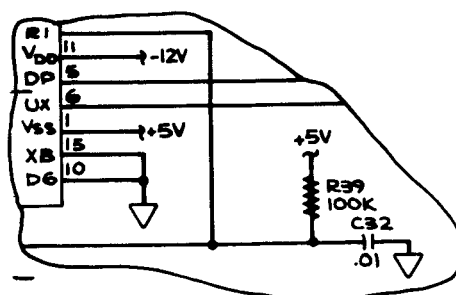


FIGURE -4

Modify following items to Figures: 8-2 (sheet 2 & 3)

- R39 10k to R39 100k, see Figure 4
- R38 1k to R38 10k, see Figure 3
- R17 22k to R17 4.7k, see Figure 2
- C32 10 uF to C32 .01 uF, see Figure 4



CHANGE #2



MAKE THE FOLLOWING CHANGES TO PARTS LIST

Delete Following Items:

R39 P/N 348920, R38 P/N 348839, C32 P/N 149153, C28 P/N 193623.

Add Following Items:

Assembly: A4 In Section 5, page 5-3, add the following to the final  
Reset PCB Assembly   
Add: A4 In Section 6, page 601-2, Table 601-1, Final Assembly,  
Reset PCB Assembly (see section 5 Final Assembly)   
In Section 5, page 5-18, add the following table and figure:

1910A/1911A Reset PCB Assembly							
REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A4	RESET PCB ASSEMBLY Figure 5-5						
C28, C32	Cap, Ta, 10 $\mu$ F $\pm$ 20%, 15V	193623	56289	196D106X 0015KA1	2		
R52, R39	Res, dep car, 10k $\pm$ 5%, 1/4W	348839	80031	CR251-4- 5P10KT	2		
R38	Res, dep car, 1k $\pm$ 5%, 1/4W	343426	80031	CR251-4- 5P1KT	1		
U15	IC, linear timer	402610	12040	LM555CN	1		
1 thru 5	Amp pins	376574	00779	3-87022-1	5		
	 Not procurable at this level						

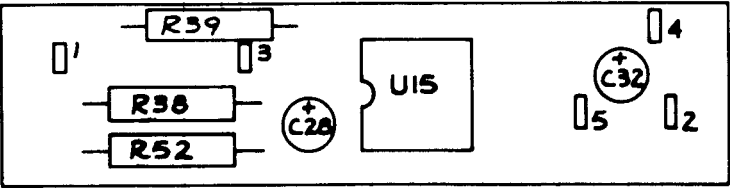


Figure 5-5. Reset PCB Assembly

**MAKE INDICATED CHANGES TO TEXT AS FOLLOWS:****Add following items:**

3-50. Reset

3-51. The model 1910A/1911A ensures that its display resets to zero after any resolution switch has been actuated by means of a Reset PCB (assembly -A4) shown in Section 5. The Reset PCB uses an IC timer (and associated circuitry) in series with S11 and U6-7 (see schematic diagram Figure 8-11) to lengthen the reset pulse generated by the resolution switches such that the bounce caused by the closing of the resolution switches will not affect the operation of the controller U6.

**Place Following Note and Table Between Paragraphs 4-19 and 4-20:***NOTE*

*Replacement of U1 may necessitate modification of resistor R20 (1.8 k $\Omega$ , deposited carbon). To determine if any modification of R20 is necessary refer to "SENSITIVITY CHECK (CHANNEL A)", Section 4 of this manual, and Table -1.*

**Table -1**

SENSITIVITY	R20	
	INSTALLED	NOT INSTALLED
HIGH	Remove R20	Calibrate Instrument
LOW	Calibrate Instrument	Install R20

**MAKE INDICATED CHANGES TO ALL SCHEMATICS, DIAGRAMS AND FIGURES AS FOLLOWS:****Delete From Figure 5-2, 601-2, 8-1 and 8-2 (sheet 2 &3)**

C28 and its ground, R38 and its +5V, R39 and C32.

**Add to Figure 8-2 (sheet 3)**

(R52, R39, C28, C32, R38 and U15) see Figure 5.



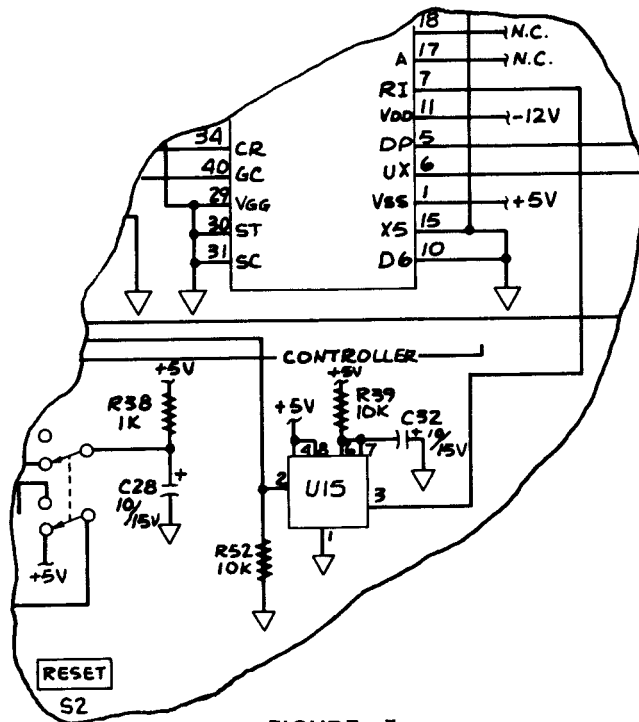


FIGURE -5

CHANGE #3-11432, 11305

**MAKE INDICATED CHANGES TO THE FOLLOWING ASSEMBLIES:****Modify the Final Assy Line Version as Follows:**

Change U7 from: 473215/55261/LS7031 to: 380238/89536/380238

**Modify Tables 5-2 and 601-2, on pages 5-5 to 5-6, 601-4 to 601-6 as Follows:**Change C9 from: Cap, cer, 0.001 uF  $\pm 10\%$ , 1 kV/368621/71590/DD-102/1  
to: Cap, cer, 0.01 uF,  $\pm 20\%$ , 100V/149153/56289/CO23B101F103/REF.Change C27 from: Cap, cer, 0.01 uF,  $\pm 20\%$ , 100V/407361/72982/812-A100-W5R-103M/1  
to: Cap, cer, 22 pF,  $\pm 20\%$ , 10 kV/369157/72982/831-000-COG0-220/REFAdd: R40/res, dep car, 100k,  $\pm 5\%$ ,  $\frac{1}{4}W$ /348920/80031/CR251-45P100KTS/REF.Delete: R54/Res, comp, 47  $\pm 5\%$ ,  $\frac{1}{4}W$ /147892/U121/CB4705/1.**Make the Following Changes to Tables 5-2, and 601-2:**

Item MP12, From: Cable Tie/331157/06383/PCT2M to: Holder, Component, Rubber/104794/98159/2829-115-3.

**Modify Figure 8-2 (sheet 1 and 3) pages 8-3 and 8-5 as Indicated by Circled Areas:**

**CHANGE #4-11245**

On Table 5-4, A1A3 250 MHz Prescaler PCB Assembly (1911A Only) make the following changes:

Q301/Xstr, Si, NPN/~~419275/453688/01295~~/~~BF357K/A5T3571~~/2  
 Q302/Xstr, Si, NPN/~~419275/453688/01295~~/~~BF357K/A5T3571~~/Ref

**CHANGE #5-11270**

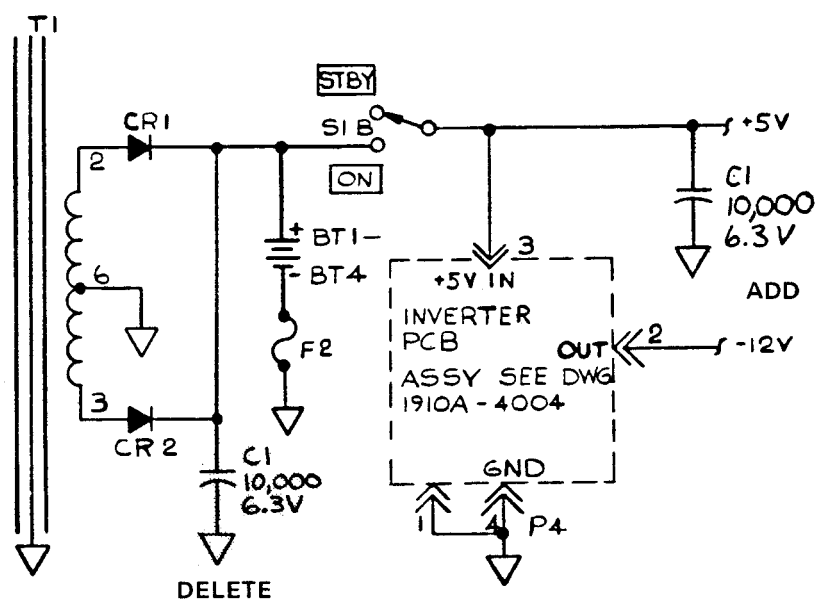
The Rev level of the 250 MHz Prescaler PCB Assembly has been incremented due to a drawing change. This change does not affect the manual or the assembly in any way other than the updating of the Rev level, from E to an F.

**CHANGE #6-11166**

Change Item CR601 and CR602 from: 407825/12969/UZ8740 to: 453134/12969/UZ8730.

**CHANGE #7-11439**

On Figure 8-1, A1 Main PCB Assembly make the following changes:



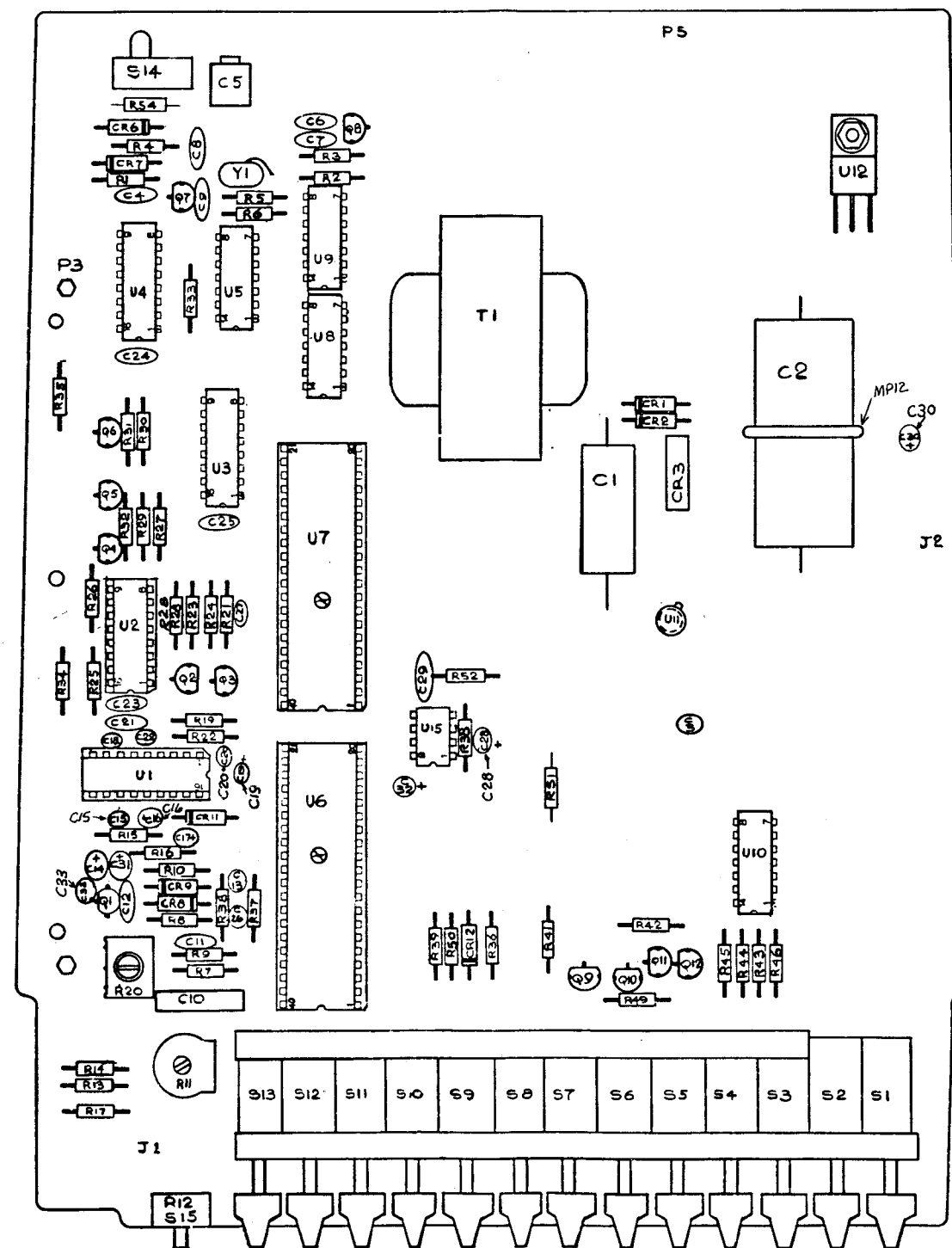
Section 8  
Schematic Diagrams

NOTE

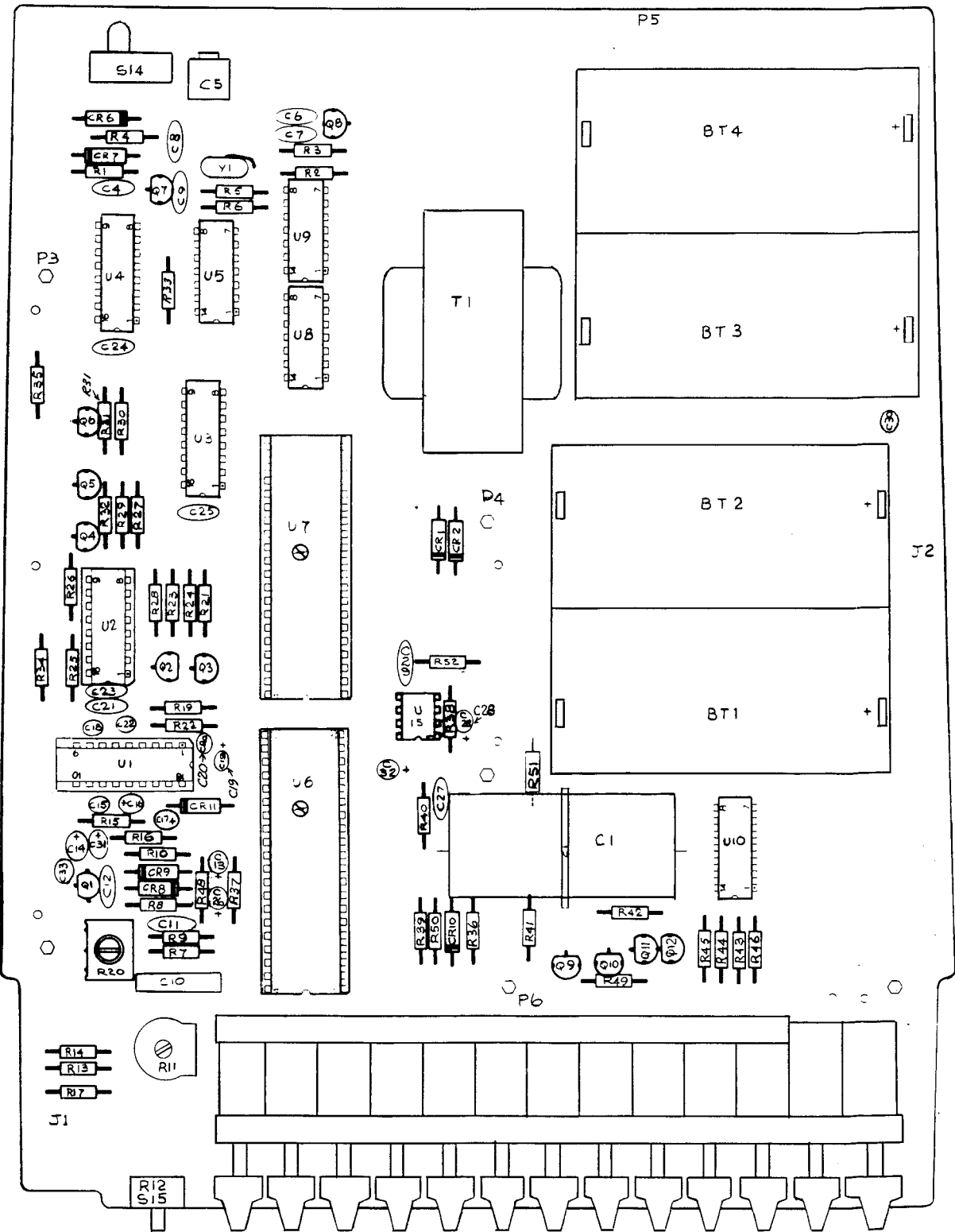
Unless otherwise specified all drawings contained in this section pertain to both the model 1910A and the 1911A multi-counters.

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8-5	A3 AC PCB Assembly (Option -01 only) . . . . .	1910A/1911A-1006	8-11
	List of Mnemonics . . . . .		8-12

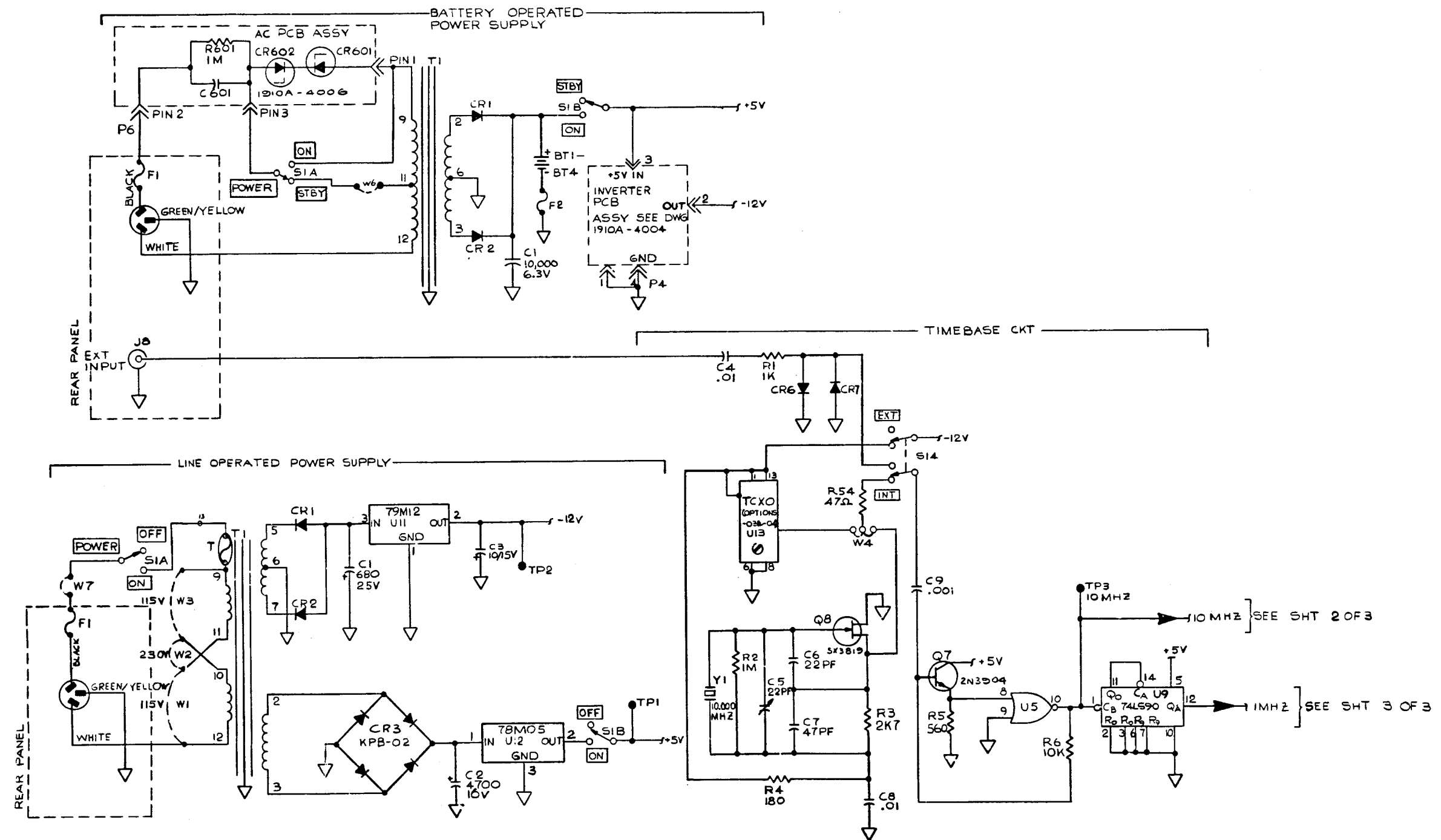


(Line Power 1910A/1911A-1601)



(Battery Power 1910A/1911A-1611)

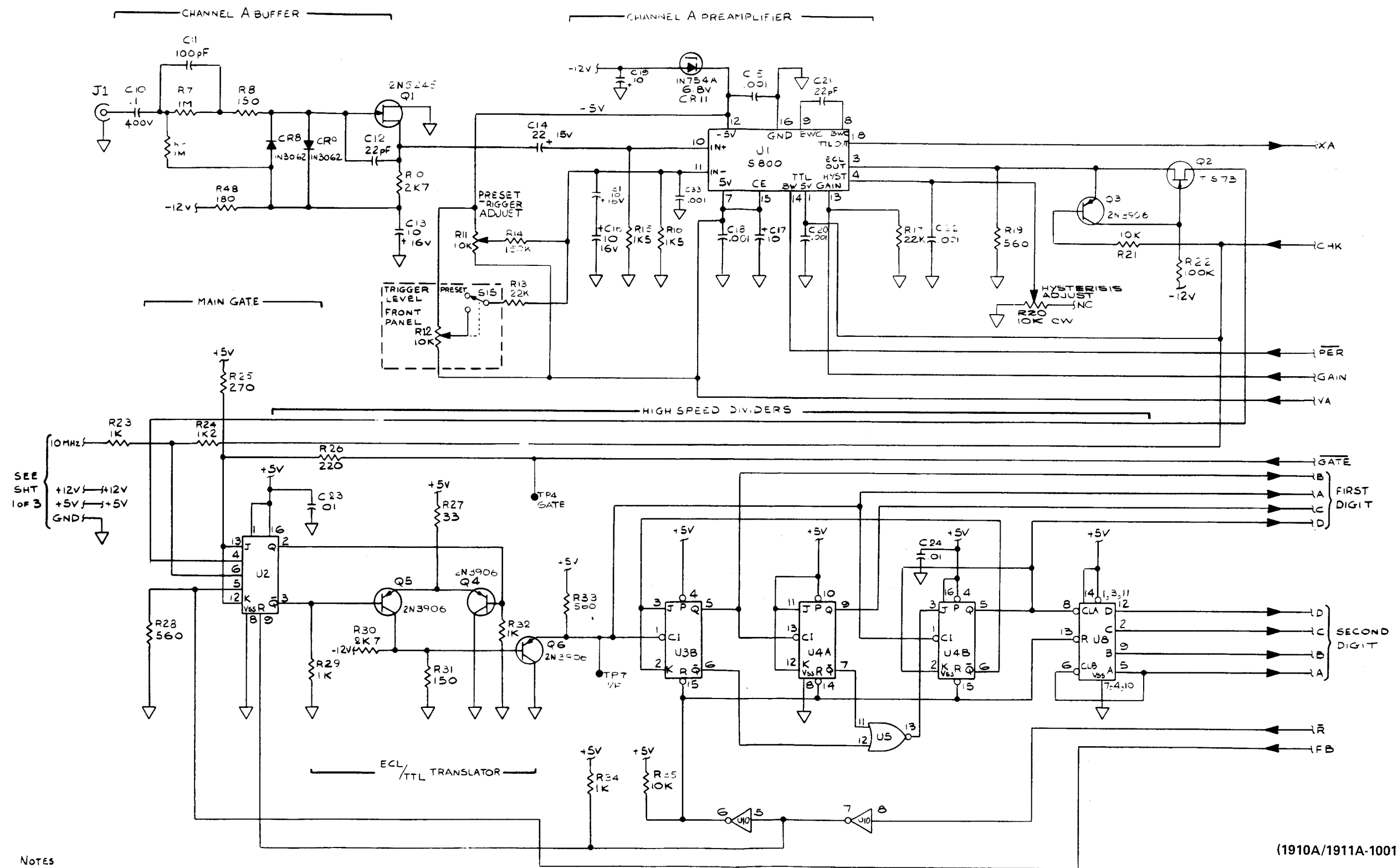
Figure 8-1. A1 Main PCB Assembly



- NOTES:
1. ALL RESISTORS ARE IN OHMS,  $\frac{1}{4}$ W, 5%CC UNLESS OTHERWISE SPECIFIED.
  2. ALL CAPACITORS ARE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.

(1910A/1911A-1001 Sheet 1 of 3)

Figure 8-1. A1 Main PCB Assembly (cont)

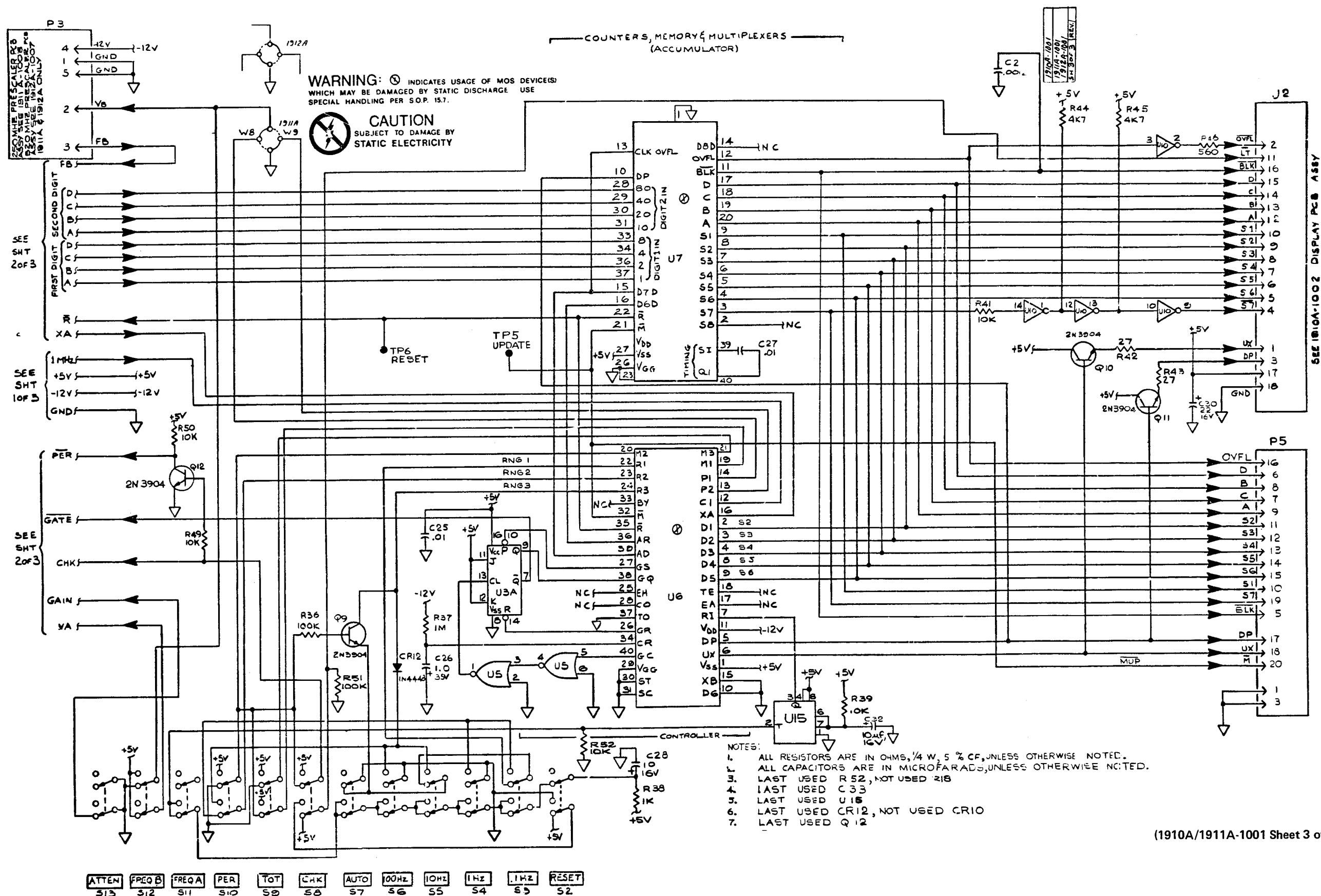
SEE SHT  
3 OF 3

## NOTES

1. ALL RESISTORS ARE IN OHMS, 1/4W, 5% CF, UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS ARE IN MICROFARADS, UNLESS OTHERWISE NOTED.

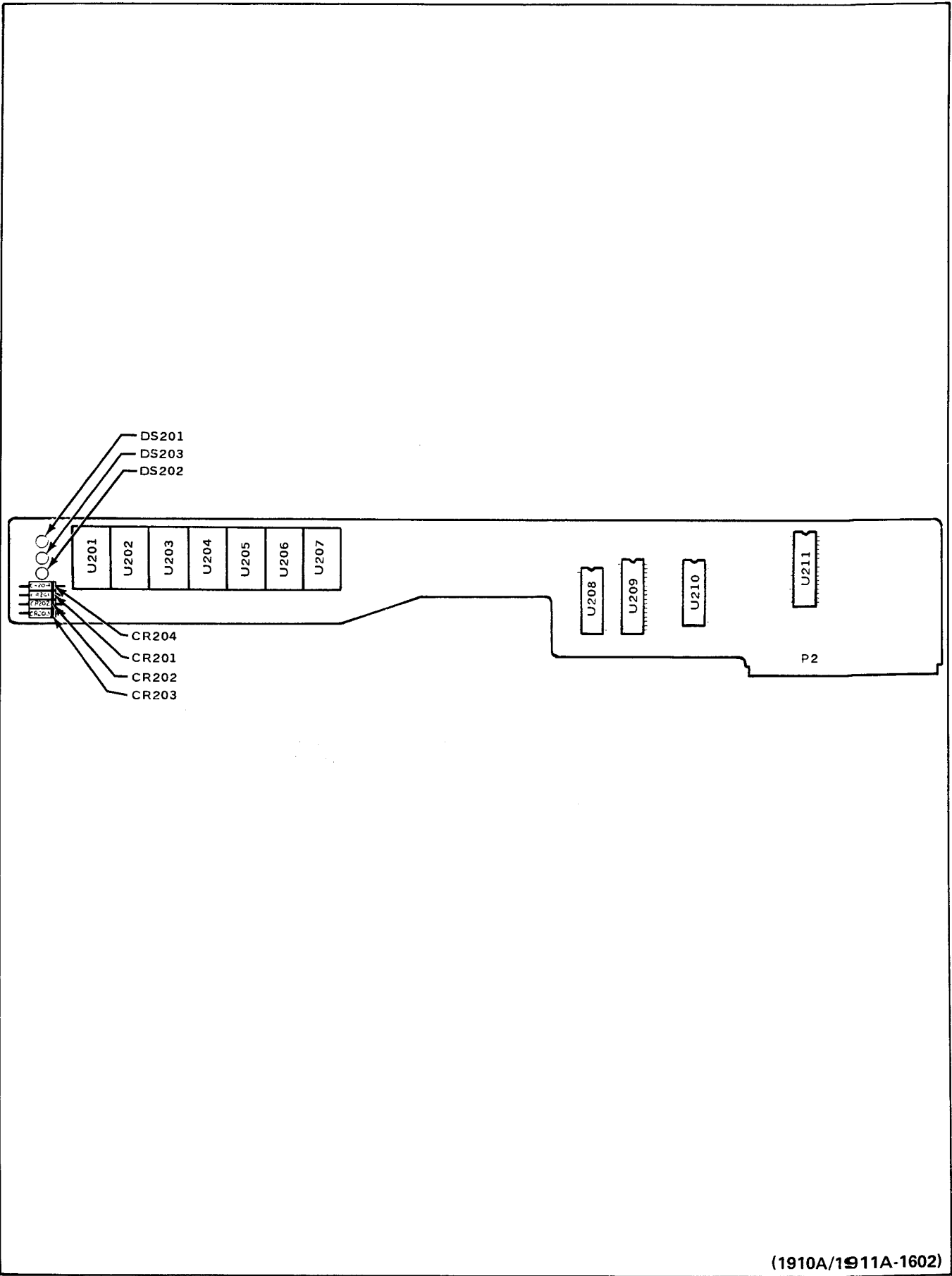
(1910A/1911A-1001 Sheet 2 of 3)

Figure 8-1. A1 Main PCB Assembly (cont)



(1910A/1911A-1001 Sheet 3 of 3)

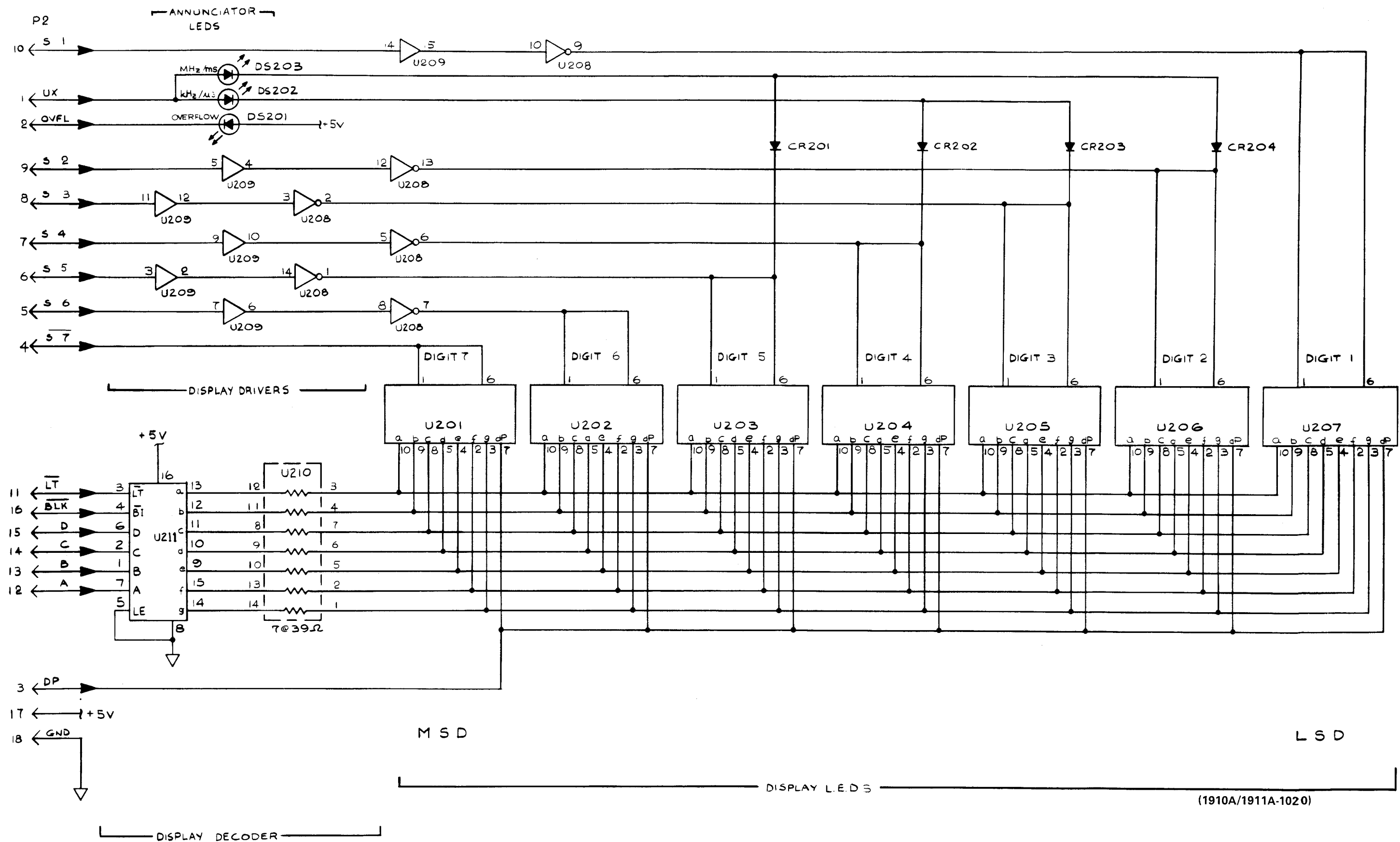
Figure 8-1. A1 Main PCB Assembly (cont)



(1910A/1911A-1602)

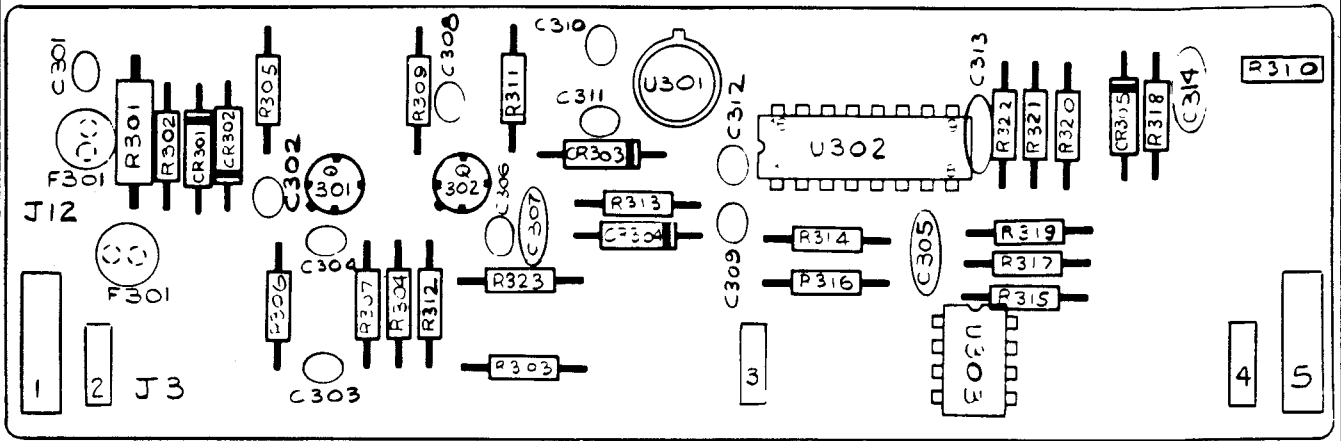
Figure 8-2. A1A2 Display PCB Assembly





(1910A/1911A-1020)

Figure 8-2. A1A2 Display PCB Assembly (cont)



(1911A- 1603)

Figure 8-3. A1A3 250 MHz Prescaler PCB Assembly (1911A only)

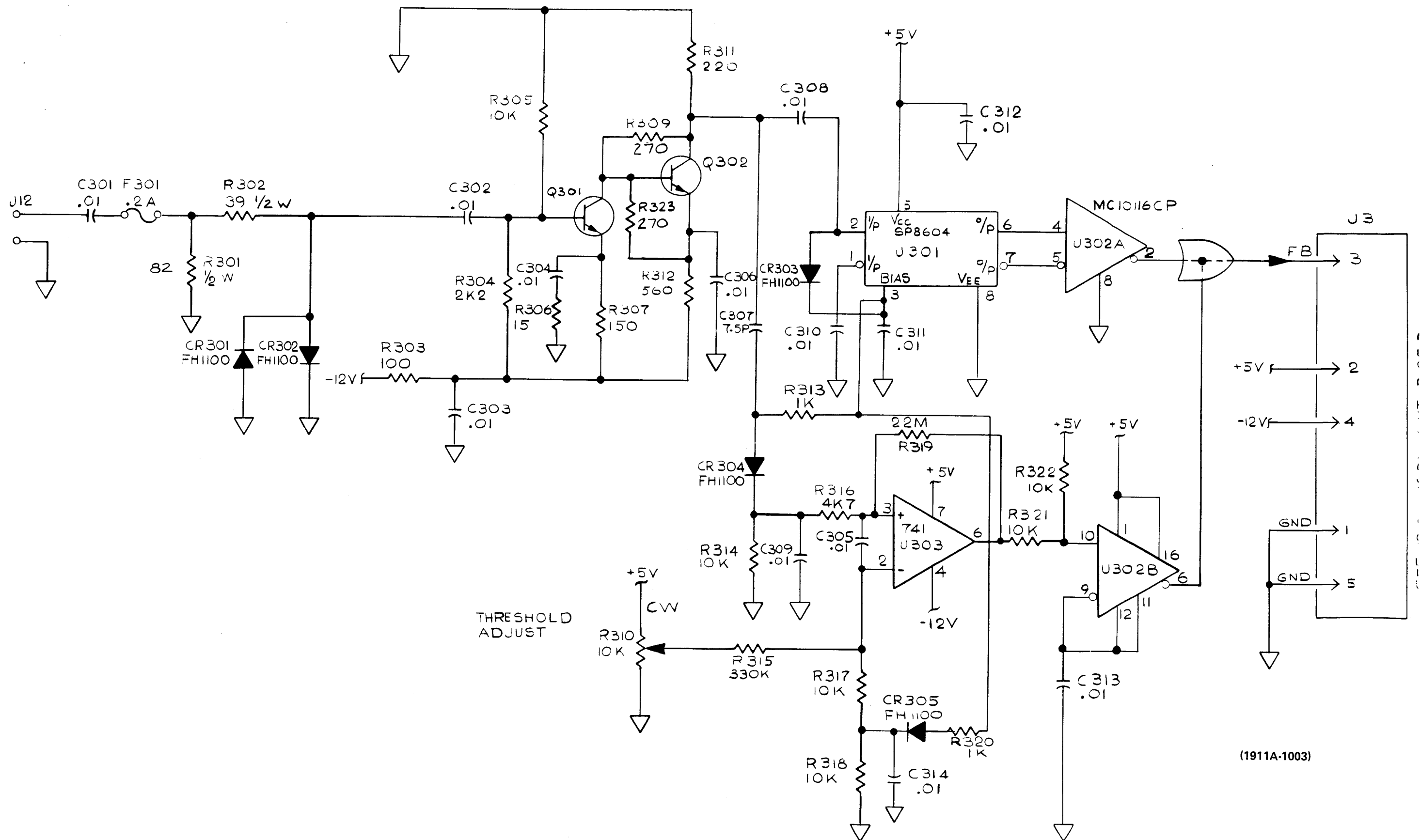
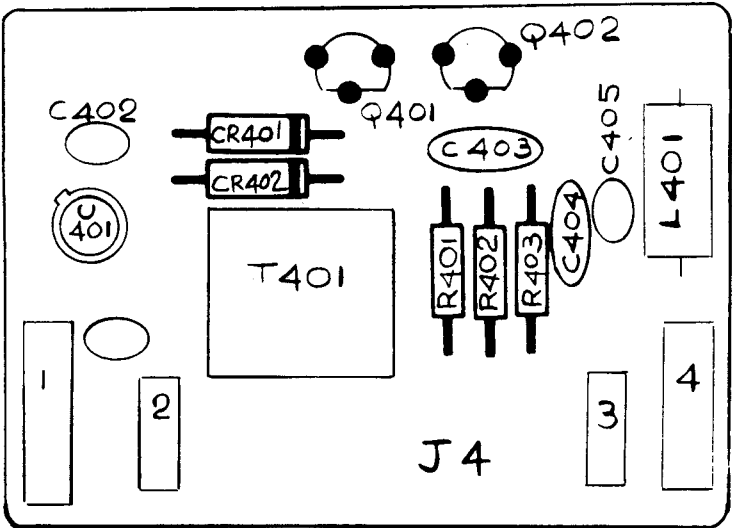
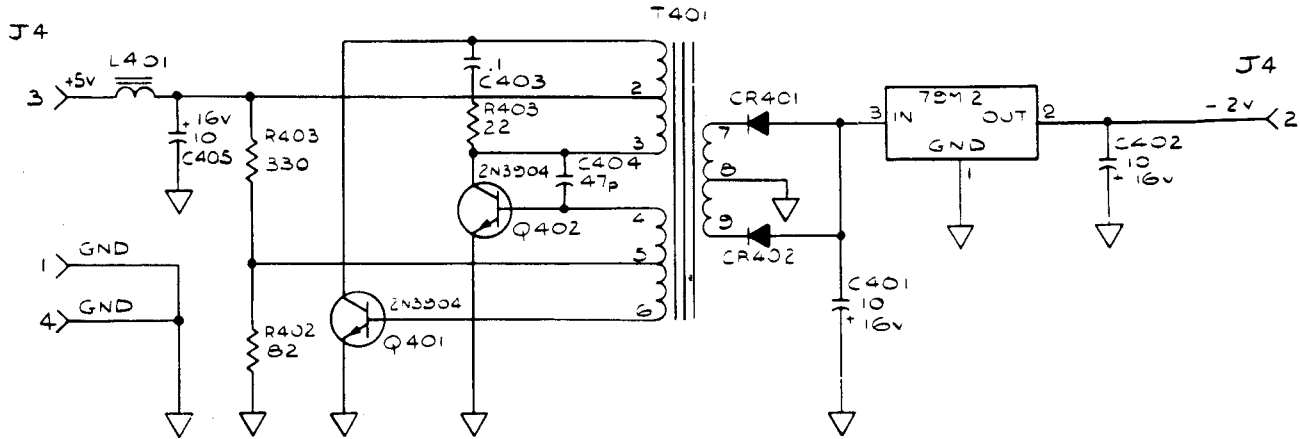


Figure 8-3. A1A3 250 MHz Prescaler PCB Assembly  
(1911A only) (cont)



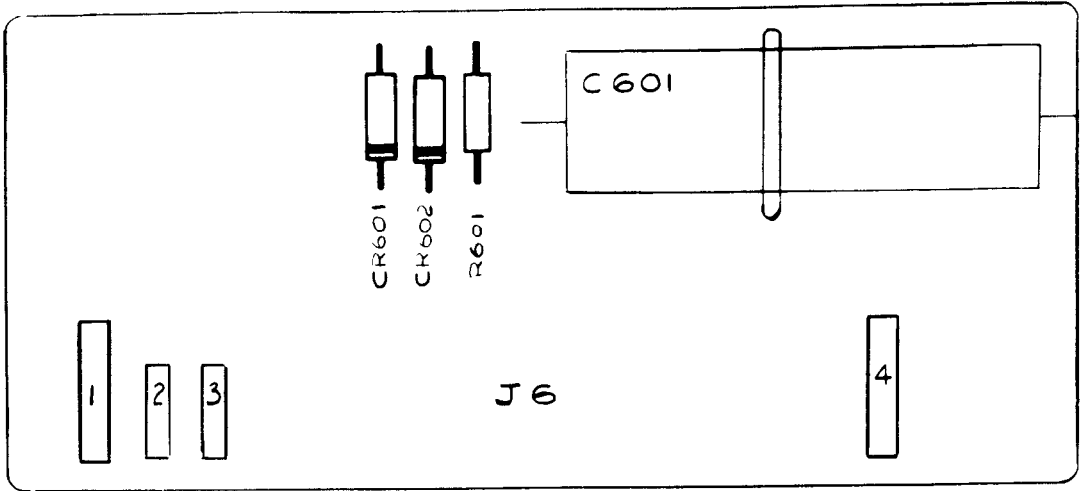
(1910A/1911A-1604)



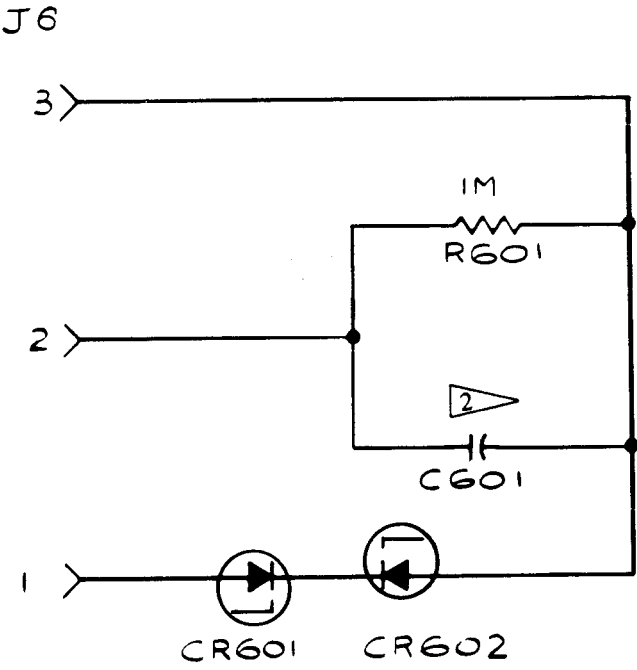
ALL RESISTORS ARE IN OHMS 1/4W 5% CC UNLESS OTHERWISE STATED.  
2 ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE NOTED.

(1910A/1911A-1004)

Figure 8-4. A2 Inverter PCB Assembly (Option -01 only)



(1910A/1911A-1606)



(1910A/1911A-1006)

2

LINE FREQUENCY Hz	VOLTAGE	C601		DWG NO.
		uF	P/N	
58-62	115/60 Hz	6	393546	1910A/1911A-1006
48-52	100/50 Hz	6.6	394189	1910A/1911A-1012
48-52	230/50 Hz	3.3	380253	1910A/1911A-1013
58-62	100/60 Hz	6	393546	1910A/1911A-1014

Figure 8-5. A3 AC PCB Assembly (Option -01 only)

## List of Mnemonics

A = BCD (1)  
 B = BCD (2)  
 C = BCD (4)  
 D = BCD (8)  
 a =  
 b =  
 c =  
 d = Seven-/Segment  
 e = decoded BCD.  
 f =  
 g =  
 ATTEN = Attenuator  
 AUTO = Autoresolution  
 BLK = Blanking Pulse to Display, low = time  
 CHK = Check  
 DP = Decimal Positioning Pulse  
 FB = Conditioned Frequency B Signal  
GAIN = Gain to U6  
GATE = Inverted Gate Pulse  
HYST = Hysteresis to U6  
M = CMOS Pulse to update memories in Display Section,  
           low = true  
 M2 = Transition pulse for period mode, blocks ECL  
           level, high = true  
MUP = M  
 OVL = Overflow  
 PER = Period  
R = TTL Pulse to Reset display decode counters  
           low = true  
 STBY = Standby  
S1; S7 = Negative switch pulse  
 S8, S9 = Switch pulse  
 TOT = Totalize  
 UX = Units annunciation, multiplexed high = true  
 VA = Chan A, 5V supply  
 VB = Chan B, 5V supply, high = true  
 XA = Conditioned Frequency A Signal, from Preamp  
       (used in period)